New Nouveau
Brunswick

Information Circular 92-1

New Brunswick's Mineral Industry 1991

Edited by

Barbara M.W. Carroll

Natural Resources and Energy

Mineral Resources

Information Circular 92-1

New Brunswick's Mineral Industry, 1991

This report has been prepared by:

Mineral Resources
Department of Natural Resources and Energy
Province of New Brunswick

Hon. Alan R. Graham
Minister of Natural Resources and Energy

Hon. Doug Tyler
Minister of State for Mines and Energy

1992

New Nouveau
Brunswick

Information Circular 92-1

New Brunswick's Mineral Industry 1991

Natural Resources and Energy
Mineral Resources

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Department of Natural Resources and Energy
Fredericton, New Brunswick

To All User Groups:

It gives me great pleasure to present "New Brunswick's Mineral Industry, 1991." This report will be a useful source of information for the minerals community and all other interested persons.

As the Government's Minister responsible for a variety of the Province's natural resources, I recognize the mineral industry's ever increasing role in the provincial economy.

I sincerely hope that this report will assist all contributors to the industry. I thank the Hon. Doug Tyler, Deputy Minister Mavis Hurley and her Mineral Resources staff for their support and dedication in 1991.

Sincerely yours,

ALAN R. GRAHAM
Minister of Natural Resources and Energy

Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

À l'attention de tous les utilisateurs
Madame, Monsieur,

Je suis très heureux de vous présenter le rapport intitulé «Rapport de 1991 sur l'industrie minière du Nouveau-Brunswick». Ce rapport constituera une source d'information utile pour le milieu minier et tous les autres intéressés.

À titre de ministre responsable de diverses ressources naturelles de la province, je reconnais le rôle toujours croissant de l'industrie minérale dans l'économie provinciale.

J'espère sincèrement que ce rapport aidera tous ceux qui contribuent à l'industrie. Je remercie le ministre Doug Tyler, la sous-ministre Mavis Hurley et le personnel des Ressources minérales de leur appui et de leur engagement au cours de 1991.

Je vous prie d'agréer l'expression de mes sentiments distingués.

Le ministre des Ressources naturelles et de l'Énergie,

ALAN R. GRAHAM

Department of Natural Resources and Energy
Fredericton, New Brunswick

To All User Groups:

The mineral industry is a major contributor to the province's economy and as Minister of State for Mines and Energy, I intend to work hard to see that the industry continues to receive the attention it deserves. I do not have to tell you that the future health of the province's mineral industry lies in the discovery of new ore reserves and the profitable development of reserves already identified. We believe that New Brunswick has the requisites investors are looking for, *viz.*, profitable mines, large geological terranes of high mineral resource potential, comprehensive data bases, knowledgeable geological staff, fair and competitive taxation policies, and sound, workable environmental laws.

As Minister of State for Mines and Energy, it is my responsibility to ensure that the mineral industry, an important part of the Provincial economy, is sustained into the 21st century. Issues facing the industry must be addressed if sustainable development is to be attained. To this end, we have prepared a discussion paper entitled, "A New Mineral Policy for New Brunswick." The document describes the mineral industry in New Brunswick, the role of various government departments in minerals management, and identifies policy options. I invite all interested parties to participate in a frank and open discussion and to formulate a policy beneficial to the people of New Brunswick and the mineral industry.

Yours truly,

DOUG TYLER
Minister of State for Mines and Energy

Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

À l'attention de tous les utilisateurs
Madame, Monsieur,

L'industrie minérale est l'une des principales sources de contribution à l'économie de la province et, à titre de ministre d'État aux Mines et à l'Énergie, je compte m'efforcer de veiller à ce que l'industrie continue de recevoir l'attention à laquelle elle a droit. Je n'ai pas à vous faire remarquer que la santé future de l'industrie minérale de la province repose sur la découverte de nouvelles réserves de minerais et la mise en valeur rentable des réserves déjà repérées. Nous croyons que le Nouveau-Brunswick répond aux exigences des investisseurs sur le plan de la rentabilité des mines, du potentiel élevé en fait de richesses minérales des grandes terranes géologiques et de la compétence du personnel géologique. Nous offrons également des bases de données complètes, des politiques fiscales justes et concurrentielles, ainsi que des lois environnementales raisonnables et sensées.

À titre de ministre d'État aux Mines et à l'Énergie, je suis chargé de m'assurer que l'industrie minérale, une part importante de l'économie provinciale, se maintienne au cours du XXIe siècle. Les problèmes auxquels doit faire face l'industrie doivent être réglés si nous souhaitons lui assurer un essor soutenu. Nous avons préparé à cette fin un document de travail intitulé «Politique du Nouveau-Brunswick sur les ressources minérales». Le document décrit l'industrie minérale au Nouveau-Brunswick et le rôle des divers ministères dans la gestion des minéraux. Il définit en outre des options d'orientation. J'invite tous les intéressés à participer à une discussion franche et ouverte ainsi qu'à formuler une politique qui sera avantageuse pour les Néo-Brunswickois et l'industrie minérale.

Je vous prie d'agréer l'expression de mes sentiments distingués.

Le ministre d'État aux Mines et à l'Énergie,

DOUG TYLER

Hon. Alan Graham
Department of Natural Resources and Energy
Fredericton, New Brunswick

Dear Sir:

I am pleased to be able to submit for your approval "New Brunswick's Mineral Industry, 1991," a report perpared by the staff of the Mineral Resources Division. It is part of the continuing effort of the Division to present quality information on the Province's mineral industry. It provides an extensive source of information and a historical record of the mineral industry for all interested agencies and persons.

Sincerely yours,

MAVIS HURLEY
Deputy Minister

L'hon. Alan Graham
Ministère des Ressources naturelles et de l'Énergie
Fredericton (Nouveau-Brunswick)

Monsieur le Ministre,

Je suis heureuse de pouvoir vous soumettre, aux fins d'approbation, le rapport intitulé «Rapport de 1991 sur l'industrie minière du Nouveau-Brunswick», qui a été préparé par le personnel de la Division des ressources minérales. Ce rapport s'inscrit parmi les efforts soutenus de la Division de présenter de l'information de qualité sur l'industrie minérale de la province. Il constitue une vaste source de renseignements et un dossier historique sur l'industrie minérale à la disposition de tous les organismes et personnes intéressés.

Recevez, Monsieur le Ministre, l'expression de mes sentiments distingués.

Le sous-ministre,

MAVIS HURLEY

Acknowledgements

Division staff members and others who have contributed sections to this report are:

F.E. Morissette
G.B. MacEwen
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Kim Stewart, Freda Kelly, Sharon McKinnon and Diane Blair contributed to the typing of this report; Gerry Johnson drafted the text on maps and Don Carroll prepared the graphs. The photographs were provided by Eric Bagnell (DNRE Communications Branch) and Les Fyffe, Allen Seaman and D.V. Venugopal (Mineral Resources Division).

SUMMARY

The Mineral Resources Division of the New Brunswick Department of Natural Resources and Energy manages the mineral resources owned by the Crown. Responsibilities include conducting basic geoscientific studies, maintaining scientific and technical data to aid mineral exploration, developing mineral management policies, issuing licences and leases, administering acts and regulations related to minerals and mining, and monitoring mining activities. Staff geologists and engineers work with other government departments, companies, and organizations on matters related to forestry, environment, and construction. The Division published approximately 105 maps and reports in 1991.

The Mining Recorder received 155 mineral exploration reports of work during 1991. Prospectors, and exploration and mining companies staked 4571 claims, mainly in search of zinc, lead, copper, and gold. The two main areas of interest were the Bathurst–Newcastle district and the Annidale area. In addition, there was interest in the Province's limestone, gypsum, dolomite, aggregate, stone, and peat resources.

In 1991, Stratabound Minerals Corp.'s 12 000 t bulk sample from the Captain North Extension (CNE) deposit was successfully milled at the nearby Heath Steele Mines facility. The company made an agreement with Heath Steele Mines who will process the CNE ore. Beausejour Peat Moss Inc. and Berger Mix Inc. were developing peat properties during the year.

During the year there were three producing metal mines and thirty producing nonmetal mines; two companies were involved in natural gas and coal production. East West Caribou Mining Ltd. is seeking a buyer for its mine, which ceased production in 1990.

The value of minerals produced in New Brunswick in 1991 was $617 007 529, down from the final 1990 value of $886 095 000. The value of nonmetal production increased slightly, while that of structural materials and fuels decreased slightly. The value of metal production was significantly reduced, mainly because of declining metal prices. Compared to mineral production in other Canadian provinces, New Brunswick's production ranked first in bismuth; second in lead, peat, and potash; and third in zinc, silver, and sulphur. New Brunswick is the only producer of marl.

SOMMAIRE

La Division des ressources minérales du ministère des Ressources naturelles et de l'Énergie du Nouveau-Brunswick est chargée de la gestion des ressources minérales de la Couronne. Parmi les responsabilités imparties à cette division, on note la tenue d'études géoscientifiques de base, le maintien à jour des données scientifiques et techniques servant à la prospection minière, la conception de politiques de gestion minière, la délivrance de permis et de baux, l'administration des lois et des règlements relatifs aux minerais et aux mines ainsi que le contrôle des activités minières. Les géologues et les ingénieurs de la Division travaillent en étroite collaboration avec les autres ministères ainsi qu'avec les représentants d'entreprises et d'organismes, sur les questions relatives à la foresterie, à l'environnement et à la construction. En 1991, la Division des ressources minérales a publié environ 105 cartes et rapports.

En 1991, l'archiviste aux mines a reçu 155 rapports de travaux d'exploration minière. Les prospecteurs miniers ainsi que les sociétés d'exploration et les sociétés minières ont jalonné un total de 4571 claims, surtout pour la recherche de zinc, de plomb, de cuivre et d'or. Les deux principales régions prospectées se trouvaient dans le district de Bathurst-Newcastle et la région d'Annidale. On s'est également intéressé aux ressources en calcaire, en gypse, en dolomite, en agrégats, en pierre et en tourbe de la province.

En 1991, un échantillon global de 12 000 t de la Stratabound Minerals Corp. a été broyé avec succès aux installations de la Heath Steele Mines situées à proximité. La firme a conclu une entente avec la Heath Steele Mines en vertu de laquelle cette dernière se chargera de la transformation du minerai de la CNE. Beausejour Peat Moss Inc. et Berger Mix Inc. ont procédé à l'ouverture de tourbières pendant l'année.

Au cours de l'année, trois mines métallifères et 30 installations de production non métallifère étaient en exploitation. Deux compagnies produisaient du charbon et du gaz naturel. L'East West Caribou Mining Ltd. est à la recherche d'un acheteur pour la mine qu'elle a cessé d'exploiter en 1990.

La valeur de la production minérale du Nouveau-Brunwick au cours de 1991 s'est chiffrée à 617 007 529 $, ce qui représente une baisse par rapport à la valeur de la production totale de 1990, soit 886 095 000 $. La valeur de la production de minéraux non métalliques a légèrement augmenté, tandis que celle des matériaux de construction et des combustibles a diminué quelque peu. La valeur de la production de métaux a substantiellement diminué, principalement en raison d'une baisse des prix des métaux. Le Nouveau-Brunswick est le seul producteur de marne au Canada.

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CHAPTER 1.
GOVERNMENT ORGANIZATION AND PROGRAMMES

MINERAL RESOURCES DIVISION

M. Fernand E. Morissette, Assistant Deputy Minister

New Brunswick has traditional responsibilities for mineral resources it owns and controls. The Mineral Resources Division of the Department of Natural Resources and Energy manages, via a number of Acts, all matters related to mineral exploration, mine development, mineral processing, and mine reclamation. The Division promotes the mineral resource potential of the Province and encourages exploration and extraction. Furthermore, it strongly supports the preservation of the environment and economic development of the minerals sector.

Through its activities, the Division is taking a more pro-active approach in dealing with the many issues affecting the growth of the mineral resources sector. More specifically, in 1992 the Division plans to initiate a series of discussions with industry in order to establish policy options and then to draft a new mineral policy for New Brunswick. This policy will ensure that the sector's contributions to the provincial economy will be sustained and enhanced. It will support the Government's commitment to the development of Mineral Resources and competitiveness of the sector.

The objectives of the Division are achieved through related activities of its three branches: Geological Surveys; Mineral Development; and Policy, Planning, and Administration (Figures 1a, 1b, 1c, and 1d). The budget expenditure supporting these objectives for the 1991–92 fiscal year was $2 871 430.18. The details of each Branch's activities are set forth in the following pages.

The Canada–New Brunswick Cooperation Agreement on Mineral Development, signed in 1990, is an initiative managed jointly by the Mineral Resources Division; the Regional Development Commission; Energy, Mines and Resources; and the Atlantic Canada Opportunities Agency. A total of $10 000 000 will be expended over five years based on a cost-sharing formula of 60% Canada/40% New Brunswick. Of the $4 000 000 earmarked for Division projects, $792 625 was spent in 1991-92 (Table 1).

The Division clientele are primarily mineral resource companies, consultants, and associations. As well, many government and paragovernment agencies and other resource-related industries utilize the geoscience information generated by staff as an integral part of the sound management of forest, water and land resources.

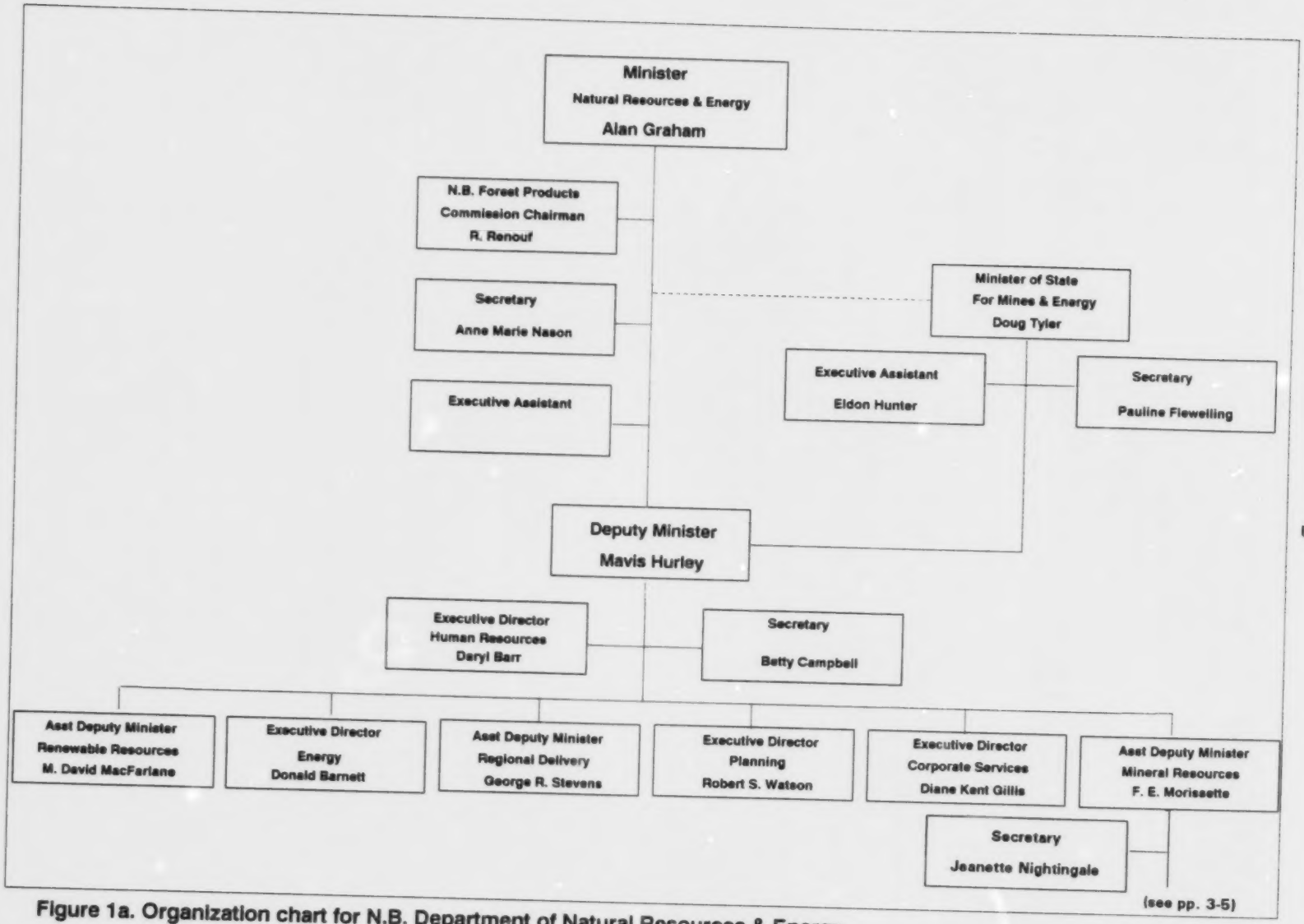

Figure 1a. Organization chart for N.B. Department of Natural Resources & Energy

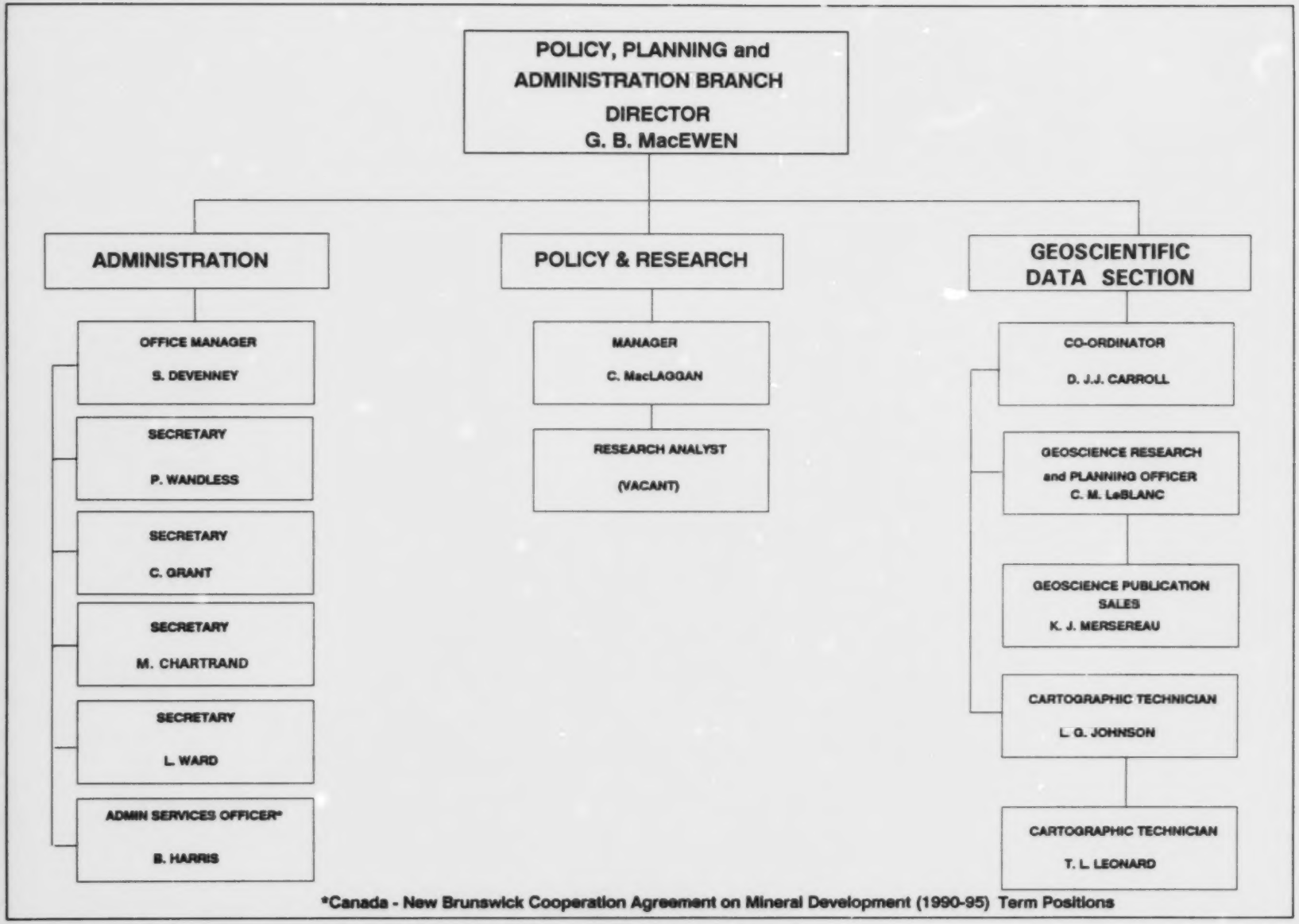

Figure 1b. Organization chart for Policy, Planning and Administration Branch

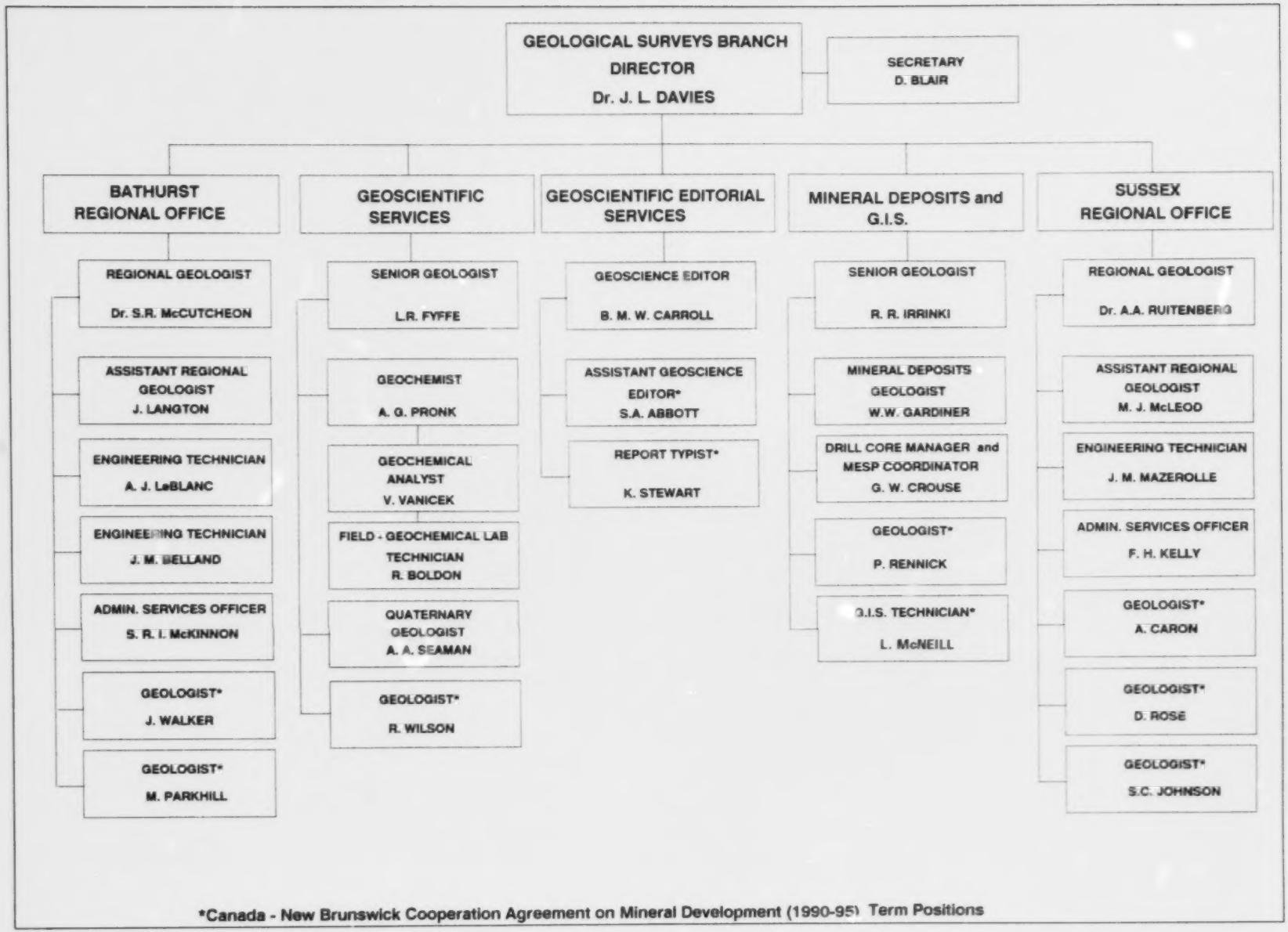

Figure 1c. Organization chart for Geological Surveys Branch

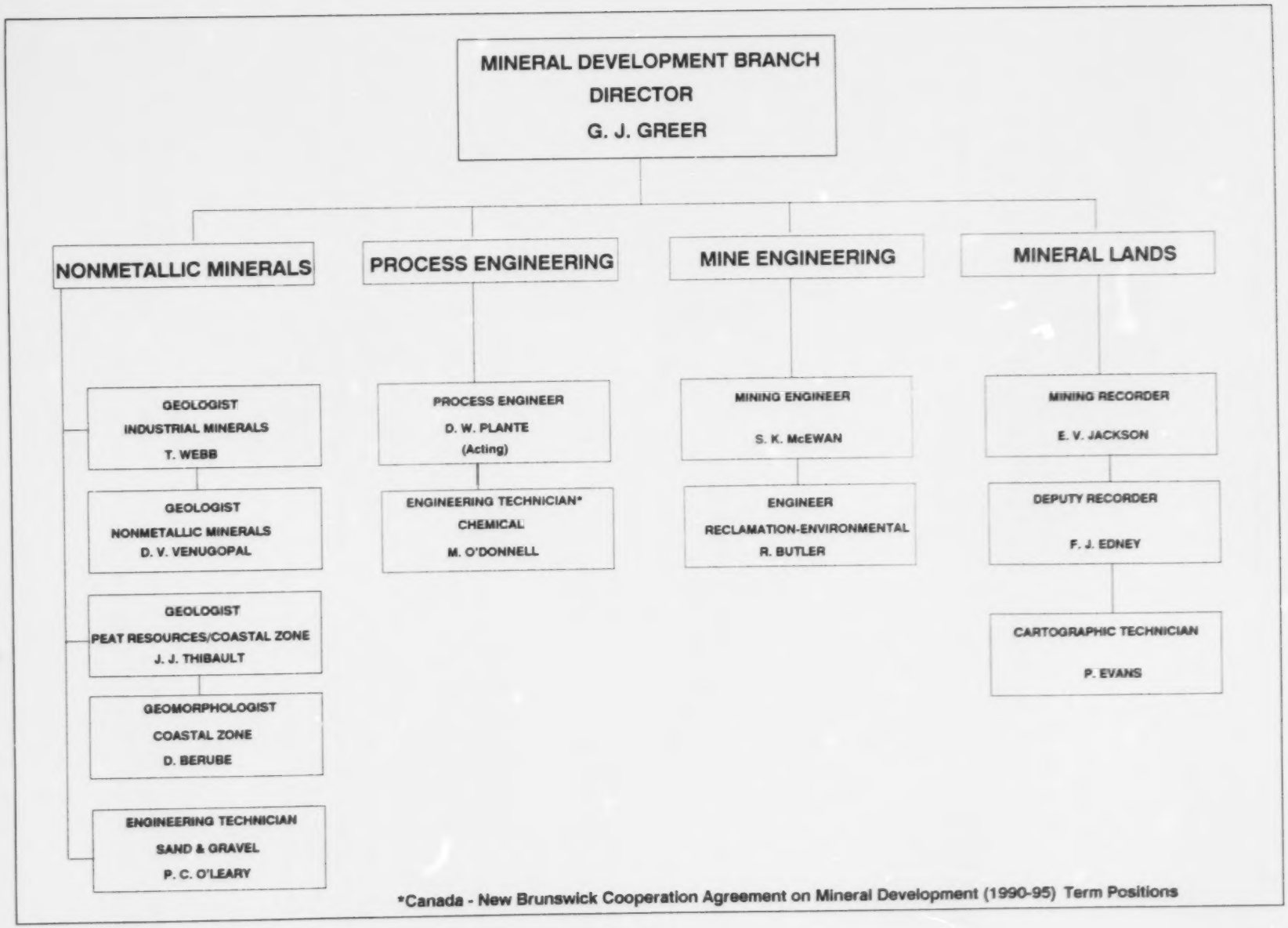

Figure 1d. Organization chart for Mineral Development Branch

TABLE 1. MINERAL RESOURCES DIVISION EXPENDITURES, 1991–92

Provincial	
Mineral Development Branch	$ 630 181.00
Geological Surveys Branch	1 377 673.41
Policy, Planning and Administration Branch	705 643.28
Minister of State for Mines	157 932.49
	$2 871 430.18
Cooperation Agreement on Mineral Development	
Provincial Expenditures	$ 792 625
Federal Expenditures	1 652 946

POLICY, PLANNING, AND ADMINISTRATION BRANCH

The Policy, Planning, and Administration Branch is one of three branches within Mineral Resources (Figures 1a, 1b, 1c, and 1d). The Branch comprises the Director's office and three sections: the Policy and Research Section, the Geoscientific Data Section, and the Administration Section (Figure 1b). Garry B. MacEwen is Director.

This Branch is responsible for providing the necessary input to policy development and planning. The Branch also provides the economic and financial analysis required to develop mineral management policies and programmes; coordinates legislative, regulatory, and programme initiatives that the Department wishes to carry forward to the Legislature; evaluates federal and other provincial government policies and programmes that affect the management of mineral resources; coordinates the development and administration of federal/provincial mineral development agreements; coordinates geoscientific information and events for public and industry consumption; and provides administrative support to the Division in the area of budget, staff, and financial information.

During 1991, the Policy, Planning and Administration Branch has worked toward achieving its mandate through its many activities. Staffing of the recently created Policy and Research Section began in 1991. This section will provide economic and financial analysis. Throughout the year, the Branch worked on a number of policy options that would increase value added through in-province processing of mineral resources. In 1991, a new potash exploration policy was introduced and negotiations were on-going with the potash producers to revise the potash lease agreements.

In 1991, the Branch worked with industry and other provincial agencies in implementing the $10 000 000 Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995) that will extend over a 5-year period.

The Branch continued to serve the public and the minerals sector by maintaining an inventory of more than 10 700 documents (maps and reports). Support services, including drafting, secretarial and clerical services, were maintained at previous levels. Public awareness activities included organizing the annual Review of Activities and participation in Mining Week. Display material was prepared and set up at the Annual Meeting and Convention of the Prospectors and Developers Association in Toronto.

Policy and Research Section

The Policy and Research Section is staffed by Catherine MacLaggan (Policy Analyst). The Research and Planning position is vacant. (Figure 1b)

In 1991, the Section began preparation of a paper entitled "Discussion Paper: Mineral Resource Policy for New Brunswick." The paper will be used during consultation with government agencies, industry, and the public as an initial stage in development of a new mineral resource policy.

The Section also provided administrative services for the federal–provincial agreements, particularly the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD). Support is also provided for a variety of budgetary and other planning activities of the Mineral Resources Division (e.g., analysis of issues related to base-metal processing, taxation).

Geoscientific Data Section

The Geoscientific Data Section consists of the following staff members: Donald J.J. Carroll (Coordinator), L. Gerard Johnson (Cartographic Technician), Terry Leonard (Cartographic Technician), Ken Mersereau (Geoscience Publications Officer), and Carol M. LeBlanc (Geoscience Research and Planning Officer). The Section is made up of two work units: Geoscientific Cartographic Services and Geoscientific Information Services (Figure 1b).

The Geoscientific Data Section is responsible for providing the staff of the Mineral Resources Division and the Energy Branch with a variety of geoscientific, technical, and support services. Also, the staff of the Section assist the public and the mineral industry by providing information and/or publications on the geology and mineral resources of the Province.

Many of the activities carried out during the 1991 calendar year are summarized below.

GEOSCIENCE PUBLICATIONS The Geoscientific Information Services Unit plays an important role in the dissemination of geoscientific data to mineral exploration and mining companies, and

to engineering, consulting, and environmental firms. The general public is also provided with nontechnical information about New Brunswick's mineral resources.

The Mineral Resources Division's geoscientific information base presently consists of approximately 6000 plates and more than 500 geoscience and technical reports. By including the 4200 mineral exploration reports of work, the information base consists of more than 10 700 documents.

In 1991, more than 1000 requests for information were filled by the Geoscientific Information Services Unit. The majority of these requests comes from three main user groups — the mineral industry, consultants and engineering groups, and agencies of the federal and provincial governments.

In 1991, the Division published approximately 105 new publications consisting of 80 plates and 25 geoscience and technical reports. The Geoscientific Data Section prepared 3 notifications that were sent to the 550 clients on our mailing list. The following is a summary of the general publication notices that were mailed during the year:

February
- List of new publications available: 42 plates, 8 reports
- Mineral Resource Report 5 (Release date: February 27)
- Notice of demonstration of Mineral Occurrence Data Base (Mineral Resource Report 3)

May
- List of new publications available: 2 plates, 14 reports, 1 Geological Survey of Canada map
- Plate 91-31 (Release date: June 18)

September
- List of new publications available: 11 plates, 5 reports, 2 Geological Survey of Canada reports
- Preliminary agenda and registration form for 16th annual Review of Activities
- Announcement of publications sale
- Notice of workshop: Computer Applications in New Brunswick Mineral Industry
- Notice of New Brunswick Prospectors and Developers Association meeting
- Notice of Geological Engineering Society open house

The distribution and sale of geoscientific publications from the Fredericton office in 1991 totalled 6925, a 13% decline from the 1990 total of 7919. The Geoscientific Information Services Unit received 44 requests for photocopies of microfiche mineral exploration reports of work. These orders represented 2400 pages of text and 800 maps. Revenue generated from the sale of publications and photocopies in 1991 was $10 461. More than 78% of publication sales were to people in the mineral industry and engineering sector.

MINERAL EXPLORATION REPORTS OF WORK A total of 155 reports of work were filed with the Mineral Lands Section in 1991. This is a small decrease from the 1990 figure of 165. The dollar value of work reported in 1991 was $9 916 301, an increase of 63% over the 1990 final total of $6 073 832. To date, approximately 4200 exploration reports of work have been filed with the Mineral Lands Section.

ANNUAL SURVEY OF MINERAL EXPLORATION EXPENDITURES In 1991, the Geoscientific Data Section assisted Energy, Mines and Resources Canada with its "Annual Survey of Canadian Mineral Exploration Expenditures — Actual 1990." The Section was responsible for mailing out questionnaires to more than 100 individuals and companies who conducted exploration activity in New Brunswick in 1990. Follow-up research and collation of the respondents' questionnaires indicated that, in 1990, approximately $17 500 000 was spent in the search for new ore deposits.

The "Survey of Canadian Mineral Exploration Expenditures — Preliminary 1991 and Forecast 1992" was a supplementary national survey that the Section carried out on behalf of Energy, Mines and Resources Canada. The survey, carried out in the fall of 1991, indicated that during that year an estimated $18 800 000 was to have been spent on exploration and that, in 1992, a $17 000 000 expenditure was forecast.

PUBLIC AWARENESS ACTIVITIES In 1991, the Geoscientific Data Section was involved in publicising the Division's extensive geoscience information base and the province's mineral resources at meetings such as: the 60th Annual Meeting and Convention of the Prospectors and Developers Association of Canada (Toronto in March); and the Division's annual Review of Activities (Fredericton in November).

The Geoscientific Data Section also responded to a number of requests for use of photographic images of the mineral resource sector that could be published in newspapers and technical journals, for existing displays, and for copies of maps to be given to delegates of technical conferences and workshops.

REVIEW OF ACTIVITIES The Division's 1991 Review of Activities was held at the Fredericton Inn on November 4th and 5th. This year's attendance (255) was up 11% from 1990. The delegates represented industry (49%), government (36%), and others interested (15%). On Monday afternoon, a special workshop entitled "Computer Applications in New Brunswick Mineral Industry" was attended by more than 80 delegates. Hon. Doug Tyler was the luncheon speaker. This was the second year that the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum held its annual general meeting in conjunction with the Review. The New Brunswick Prospectors and Developers Association once again held its meeting in conjunction with the Review.

LARMOND MINERAL AND FOSSIL COLLECTION In 1991, the Department of Natural Resources and Energy acquired a valuable mineral and fossil collection (Figure 2) through a generous donation from Richard Larmond of Charters Settlement. Mr. Larmond has been

Figure 2. Premier McKenna and Dr. J.L. Davies examine the portion of the Larmond mineral and fossil collection that was displayed at the Division's Review of Activities.

Figure 3. Grade six students of the Blacks Harbour Elementary School, winners of the Mining Week mascot contest, each received a "Miner Al" poster and a pewter "prospector" lapel pin.

early childhood. The Larmond Collection consists of more than 700 mineral, 50 fossil and 70 modern shell specimens from such diverse locations as Germany, Turkey, Ireland, Iran, Peru, and Mexico. The collection incudes an uncut fire opal, a large "desert rose," a metre-long piece of petrified wood, and spectacular amethyst crystals.

MINING WEEK A major public awareness activity for the mineral industry in 1991 was the third annual New Brunswick Mining Week, held May 27–June 1. The theme this year was "Minerals Matter." The New Brunswick Mining Association was the main force behind the event but other groups and agencies such as the New Brunswick Prospectors and Developers Association, the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum, the New Brunswick Mining and Mineral Interpretation Centre, N.B. Coal Ltd., and the Communications Branch of the New Brunswick Department of Natural Resources and Energy played a participatory role in some of the week's activities. Displays at malls, special guest speakers, radio promotional ads, open houses, newspaper advertisements, and a special CIM newsletter were some of the activities carried out or materials produced for Mining Week 1991.

One of the highlights was a contest for Grade 6 students throughout the province. They were asked to submit their ideas for a mascot for Mining Week. More than 30 entries were received. The class from Blacks Harbour (Figure 3) won the contest with "Miner Al," a mole whose natural affinity is for underground excavation.

The Communications Branch of the Department of Natural Resources and Energy, utilizing funds from the CAMD, commissioned the production of a 30-second television ad called "Minerals Matter." The ad was televised over all English and French stations during Mining Week 1991 and also during the Division's annual Review of Activities.

The main project of the New Brunswick Mining Association was the production of a 20-page Mining Week 1991 newspaper supplement.

Administration Section

Secretarial and clerical support staff includes Sandra DeVenney (Office Manager), Linda Ward (Administrative Services Officer), Carol Grant (Secretary), Monique Chartrand (Secretary), Barbara Harris (Administrative Services Officer, CAMD), and Pamela Wandless (Secretary).

The Administration Section provides the financial, administrative, and secretarial support to the Division. The work involves budget control, processing pay documents, typing, answering incoming calls, directing visitors to appropriate areas and providing financial and administrative information.

The Provincial A-base budget expenditures and Federal/Provincial agreement expenditures for the Division (1991–92) are summarized in Table 1 and Figure 4.

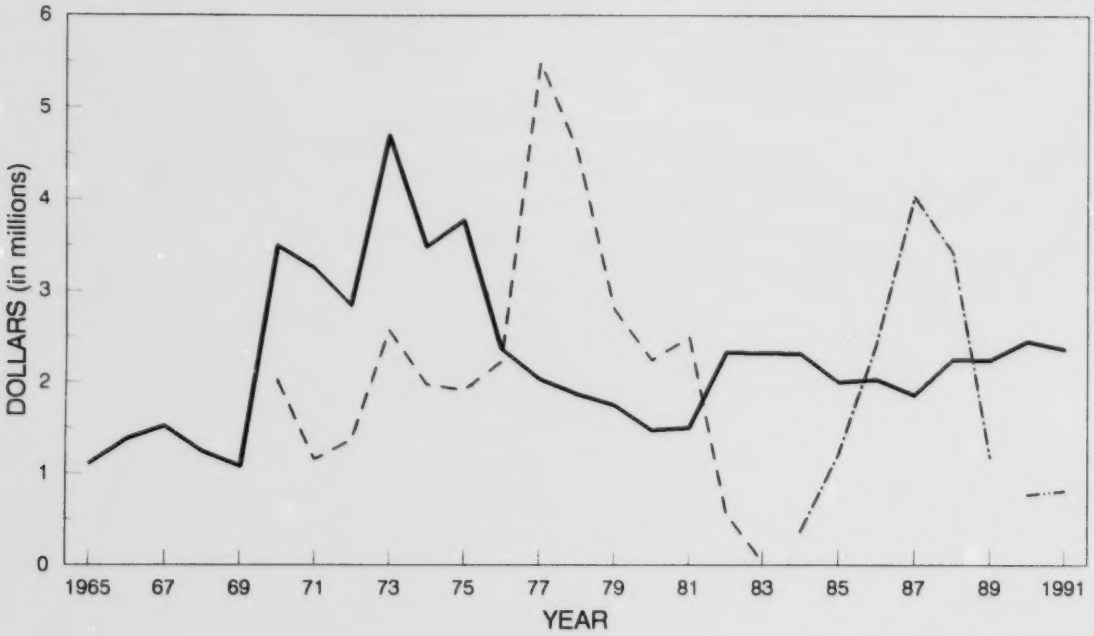

Figure 4. Budget of Mineral Resources Division, 1965 to 1991, showing expenditures under Federal/Provincial agreements. Legend: —— Department A-base; – – – – Dept. of Regional Economic Expansion; –·–·– Canada–New Brunswick Mineral Development Agreement; –··–··– Canada–New Brunswick Cooperation Agreement on Mineral Development. ($ 1986 = 100)

GEOLOGICAL SURVEYS BRANCH

The Geological Surveys Branch consists of the Bathurst Regional Office, the Sussex Regional Office, the Geoscientific Services Section, the Mineral Deposits and Geographic Information Systems (GIS) Section, and the Geoscientific Editorial Services Section (Figure 1c). Dr. J.L. Davies is Director.

The Geological Surveys Branch is responsible for the collection, interpretation, dissemination, and management of geoscience data in New Brunswick. The Branch goals are to decipher the regolith and bedrock framework of the Province, and to identify the mineral resource potential of the various geological terranes. Closely related activities include: encouraging mineral exploration; promoting the mineral industry; and advising government on management of mineral, water, and land resources.

The Branch's long-term or global objectives entail determining the regolith and bedrock geology of New Brunswick; identification and location of areas of mineral resource potential; encouragement of mineral exploration; and intelligent management of mineral, water, and land resources. As well as providing assistance on geological matters, staff of the Branch provided advice on groundwater exploration and regional waste disposal. The Branch encourages mineral exploration through staff attendance at, participation in, and organization of conferences, geoscience meetings and field workshops (e.g., the Annual Meeting and Convention of the Prospectors and Developers Association, the Division's Review of Activities, and the joint meeting of the Canadian and American Quaternary associations). Results of programmes are published by the Division in the form of reports and maps, and research may be reported in geoscientific journals. The high standards required by the geoscience community are maintained by the geoscience editorial group. A Geoscience Information System, featuring CARIS software, manages the geoscience data base for the Mineral Resources Division.

Interim objectives are focused on the needs of the mineral industry. Priorization is achieved through consultation with the industry via the New Brunswick Prospectors and Developers Association and the New Brunswick Mining Association. A number of ongoing projects are designed to help the Branch meet these objectives. The Antinouri–Nicholas, Halfmile Lake–Heath Steele, southern New Brunswick regional compilation and mapping, and St. Stephen projects encompass bedrock geological mapping, mineral resource identification and location, and compilation of existing data. The Lake George antimony–gold and Brunswick studies, the computerized mineral deposits data file project, and the comparative metallogenic investigation (southern New Brunswick) will contribute to the body of geological and mineral deposit information available to industry and other user groups. Upon completion, geochemical and Quaternary mapping projects in the Pokiok Batholith area will provide valuable data for mineral exploration and forest site classification (Figure 5).

Provincial A-base budget expenditures for the Geological Surveys Branch amounted to $1 377 673 in 1991–92. A five-year, $10 000 000 Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD), signed in 1990, calls for the expenditure of $4 000 000 on geoscience programmes on a cost-shared basis of 60% Canada, 40% New Brunswick. The provincial geoscience expenditure of $451 000 funded 9 projects in 1991–92. The federal geoscience expenditure was $951 000 (14 projects).

Bathurst Regional Office

The staff of the Bathurst Regional Office in 1991 consisted of Steven McCutcheon (Regional Geologist), John Langton (Assistant Regional Geologist), Sharon McKinnon (Administrative Officer and Deputy Recorder), André LeBlanc and Maurice Belland (Engineering Technicians). Mike Parkhill and James Walker are contract geologists responsible for projects funded through the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD). Susan Gower, Janice LeBlanc, David Bance, Doug Clark, and Peter Banks were hired as summer personnel.

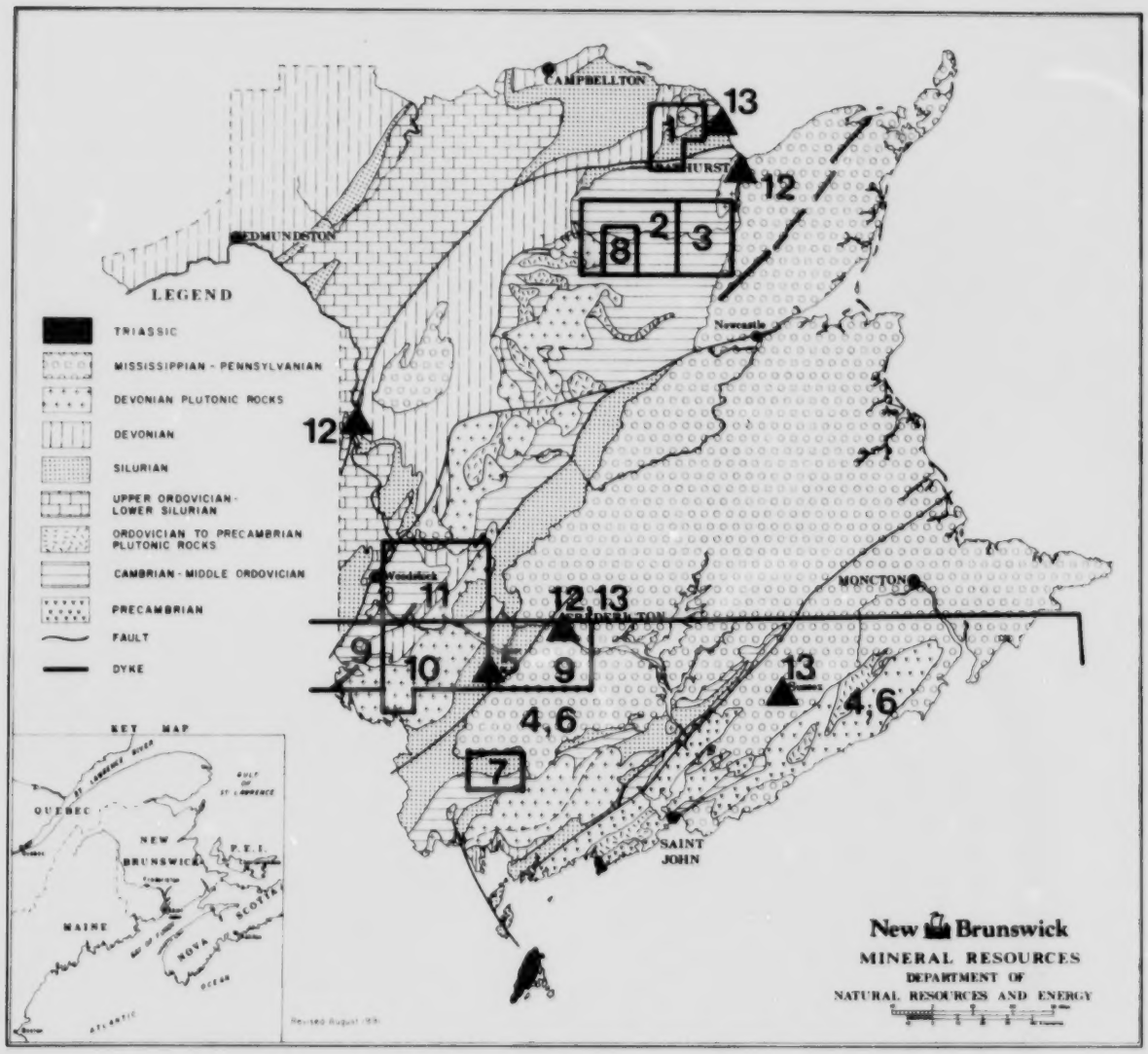

Figure 5. Areas in which Geological Surveys Branch projects were conducted in 1991: (1) Antinouri–Nicholas, parts of 21 O/16, 21 P/12,13 (CAMD and Prov.); (2) California Lake, 21 O/8 (CAMD); (3) Brunswick project, 21 P/5W (Prov.); (4) Southern New Brunswick regional compilation and mapping programme, 21 G, 21 H (CAMD); (5) Lake George project (CAMD); (6) Computerized mineral deposits data file project, 21 G, 21 H (CAMD); (7) Flume Ridge–Kedron Stream area, 21 G/6h and 21 G/7e (Prov.); (8) Halfmile Lake–Little Bald Mountain, part of 21 O/8 (CAMD); (9) Geochemical survey in Pokiok area, 21 G/13 and 21 G/15 (Prov.); (10) Surficial geology in Pokiok area, 21 G/14 and part of 21 G/11 (CAMD); (11) Millville area, 21 J/3 (Prov.); (12) Prospecting courses, Bathurst, Perth-Andover, Fredericton (CAMD and Prov.); (13) Drill-core repositories, Madran, Fredericton, Sussex (Prov.).

Editor's Note: Projects commonly consist of a number of phases that are carried out by staff from different sections and branches of the Division. In order to find all the information on particular projects mentioned in the remainder of this chapter, please refer to the index.

MAPPING PROJECTS The **Antinouri-Nicholas project** (Figure 5:1), conceived as a five-year programme, will have a duration of three years because of limited funding under CAMD. The project area, about 900 km^2, extends from Jacquet River in the northwest to Robertville in the southeast and encompasses the mineral occurrences/deposits in the vicinity of the Antinouri Lake–Nicholas Denys intrusive complex, which lies to the northwest of Bathurst.

This project is an integrated study consisting of several subprojects or phases. Phase one is geological mapping. In 1990, map areas 21 O/16a and 21 P/13d (1:20 000 scale) were completed. Work on map areas 21 P/12e, 12f, 12g, and 21 P/13b and 13c continued in 1991. Phase two, mineral occurrence studies, began in 1990 and continued this year. Approximately two thirds of the 243 mineral occurrences have been field checked and 100 have been sampled. Phase three, compilation of assessment data, also was begun in 1990; map areas 21 P/12e, 21 P/13d, and 21 O/16a are completed and work is progressing on 21 P/12f, 12g, and 21 P/13c.

In order to provide age constraints on the intrusive activity, samples were submitted to M.L. Bevier at the Geological Survey of Canada (GSC) Geochronology Laboratory for radiometric dating. U-Pb ages of 381±4 Ma and 372±4 Ma were obtained from the Nicholas Denys Granodiorite (tonalite) and the Antinouri Lake Granite, respectively.

Also, a 25 line-kilometre gravity survey in the northern part of the Nigadoo Syncline was conducted under contract by Northeast Exploration Services Limited. The objectives were to determine if the Nigadoo Porphyry has a gravity expression and to establish a gravity profile across the entire intrusive complex. The resulting digital data will be incorporated into the on-going gravity modelling of M.D. Thomas at the GSC Geophysics Division.

The **California Lake till-sampling project** began in 1990 under the CAMD. In 1991, M. Parkhill, assisted by D. Bance, completed the regional sampling and surficial mapping of the California Lake (21 O/8) map area (Figure 5:2). Duplicate samples were collected at a number of sites for Noranda Technology Centre who will conduct geotechnical testing. In addition, detailed sampling was completed around the Halfmile Lake base-metal deposit in anticipation of future developments at this locality. Providing funds are available, till sampling will be conducted over the west half of the Nepisiguit Falls (21 P/5W) map area in 1992.

The **Brunswick project** is a provincially funded study of Tetagouche Group rocks that overlie and underlie the "Brunswick horizon." The objectives are to: (1) define the internal stratigraphy of the felsic volcanic pile, (2) determine if there is one or more than one ore-bearing horizon, and (3) show its (their) distribution on 1:10 000 and 1:20 000 scale geological maps and sections. The project, which began in the vicinity of the Brunswick No.6 open pit, will encompass

most of the Nepisiguit Falls (21 P/5W) map area (Figure 5:3). In 1990, the results of preliminary geological mapping in map areas 21 P/5-101, 5-102, 5-201, and 5-202 (1:10 000 scale) were reported. In 1991, J. Langton, assisted by P. Banks, continued mapping in this area, extending coverage to map areas 21 P/5-103, 5-203, 5-301, 5-302, and 5-303.

CORE STORAGE In 1991, 25 523 m of core was turned over to the Division and stored at the Madran core respository (Figure 5:13). Corona Corporation turned over all its drill core to the Division before closing its Bathurst office; about 16 483 m of core was moved to Madran. Also, 9040 m of core from Marshall Minerals Corp.'s definition drilling programme at the Restigouche deposit was taken to Madran.

PAPERS/REPORTS S.R. McCutcheon edited a group of eight papers on the geology and mineral deposits of the Bathurst camp. These papers arose from the Base Metal Symposium held in Bathurst in 1990 and will be published in the second issue of *Exploration and Mining Geology*, the new journal of the Geological Society of the Canadian Institute of Mining, Metallurgy and Petroleum. This issue should be published in 1992. A paper by S.R. McCutcheon and M.L. Bevier describing the timing of deformation and gold mineralization in the Upsalquitch area of northern New Brunswick was published in *Atlantic Geology*. S.R. McCutcheon and M. McLeod made final corrections to two papers that describe the geology of Late Precambrian and Early Paleozoic rocks in southern New Brunswick. These papers will be published by the Geological Survey of Canada in Chapter 3 of "Geology of the Appalachian/Caledonian Orogen in Canada and Greenland," edited by H. Williams.

COMMITTEES S.R. McCutcheon was part of the selection committee that reviewed applications for funding under the Mineral Exploration Stimulation Program (MESP). He reviewed several Environmental Impact Assessment draft reports for the Department of the Environment. As a resource person for the mining sector, he attended the sectorial-table meetings involved with planning the economic development conference for the Chaleur Region, which was held in the fall of 1991.

FIELD WORKSHOPS Field workshops were conducted at mineral properties held by the following companies and prospectors: Brunswick Mining and Smelting Corporation Limited; Falconbridge Limited; Noranda Exploration Company, Limited; NovaGold Resources Inc.; Teck Corporation; BHP-Utah Mines Ltd.; Northeast Exploration Services Limited; Wayne Carroll; Raoul Lagacy; and Wilfred Hachey. Ad hoc workshops were provided for a number of company geologists.

CONVENTIONS Poster displays were taken to the Atlantic Geoscience Society's annual meeting in Amherst. J. Walker, S. Gower, and S. LeBlanc presented a display entitled "Siluro-Devonian Tectonostratigraphic Relationships, Western Margin of Elmtree Inlier, Northern New Brunswick." M. Parkhill presented another entitled "Surficial Geology of the Nepisiguit Lakes Map Area, Emphasizing Till Clast Composition, Miramichi Highlands, North-central New Brunswick." The abstracts for the posters have been published in Volume 27 of *Atlantic Geology*.

M. Parkhill contributed to the Canadian Quaternary Association (CANQUA) biennial meeting in Fredericton. He presented a poster entitled "Surficial Geology of the Nepisiguit Lakes and California Lake Areas, Miramichi Highlands, Northern New Brunswick" and, with A.G. Pronk, was joint author of a paper given by A. Seaman entitled "Quaternary Geology of New Brunswick: Seven Years Later."

J. Langton prepared part of the display that was taken to the Annual Meeting and Convention of the Prospectors and Developers Association in Toronto. However, year-end travel restrictions prevented attendance by Bathurst office staff. He has also begun preliminary preparations for the field workshop that will be held in the Bathurst camp in conjunction with the Joint Annual Meeting of the Geological Association of Canada/Mineralogical Association of Canada in the spring of 1992. Preparation of the guidebook is also in progress.

OTHER ACTIVITIES J. Walker and M. Parkhill participated in a job shadowing programme for students of Bathurst High School. They and J. Langton also took part in a career expo at Bathurst Junior High.

Geological advice was provided to many exploration geologists and prospectors. In addition, M. Parkhill provided help to a number of engineering firms (including Roy Consultants and Noranda Technology Centre) interested in finding solid waste disposal sites and/or cover materials for tailings and waste rock. S.R. McCutcheon and J. Walker inspected the bedrock foundation of N.B. Power's Belledune River dam site at the request of Acres International, a geotechnical consulting firm hired by N.B. Power. S. McKinnon, A. LeBlanc, and M. Belland provided support services to explorationists and the geological staff in their usual efficient manner.

Sussex Regional Office

In 1991, the staff of the Sussex Regional Office consisted of Arie A.Ruitenberg (Regional Geologist), Malcolm J. McLeod (Assistant Regional Geologist), J. Maurice Mazerolle (Engineering Technician), and Freda H. Kelly (Administrative Services Officer). Alain Caron and Susan C. Johnson were employed on long-term contracts associated with the Canada–New Brunswick Cooperation Agreement on Mineral Development.

FIELD WORKSHOPS/CONSULTATIONS M.J. McLeod and A.A. Ruitenberg conducted field examinations of several mineral properties held by various mining companies in southern New Brunswick. Consulting services were also provided for numerous exploration geologists, prospectors, engineers, foresters, and hydrologists. Demand for geologic advice on activities related to groundwater exploration, regional waste disposal, and other environmental problems continued to increase in 1991. F.H. Kelly and J.M. Mazerolle continued to provide their efficient support services to the mineral industry and geological staff.

COMMITTEES H.D. Craig (Dept. of the Environment) and A.A. Ruitenberg were appointed co-chairs of the Groundwater Advisory Committee, which was recently established by the two departments. Subcommittees were formed on: (1) computerization of groundwater data, and (2) siting criteria for regional waste disposal facilities.

MAPPING PROJECTS M.J. McLeod and A.A. Ruitenberg continued to field check the problem areas of southern New Brunswick (parts of 21 G and 21 H). After returning from maternity leave in August, Susan Johnson continued geological map compilation. Three 1:50 000 geological maps, Plates 90-152, 90-153, and 90-154 (21 G/9, 21 H/12 and 21 H/13), were field checked and compiled. A preliminary geologic–metallogenic map of the Fredericton (21 G) map area and parts of the Amherst (21 H) map area at a scale of 1:250 000 was also prepared. This project is part of the **southern New Brunswick regional compilation and mapping programme** (Figure 5:4), conducted under the auspices of the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD). The most important result of 1991 activities was to provide reliable geological maps to guide exploration in the recently delineated Lower Ordovician bimodal volcanic rocks in the Annidale area, which has potential for base-metal sulphide and gold deposits. These rocks are similar to rocks that crop out along the eastern shore of Penobscot Bay in Maine where they host the Harborside base-metal sulphide deposit and numerous other occurrences.

A. Caron and K. Jones mapped the geology and many mineral occurrences associated with skarn zones along the contact aureole of the Pokiok Batholith to the southwest and northeast of the Lake George antimony–gold deposit. The **Lake George project** (Figure 5:5) is being conducted under the auspices of the CAMD. This information is being integrated with geological data obtained from underground mapping at the Lake George deposit and drill core logging. The field data is also being correlated with detailed airborne magnetic, gradiometer, and very low frequency electromagnetic maps produced by the Geological Survey of Canada during the summer and fall of 1991. J.M. Mazerolle and M.P. Rennick completed a digital compilation of geochemical stream-sediment data for the Lake George area to complement this CAMD-sponsored project. The compilation data will be published as an Open File Report.

As a supplement to the **New Brunswick computerized mineral deposits data file project**, D.G. Rose located and described several additional mineral occurrences covered by 1:250 000 scale map sheets 21 G and 21 H (Figure 5:6). The results of this work were used to update the computerized mineral occurrence data base. The discovery by D.G. Rose of high-grade tin-bearing float at True Hill, west of Mount Pleasant, resulted in the staking of several claim groups.

PAPERS/REPORTS M.J. McLeod and S.R. McCutcheon contributed geologic descriptions of the Avalon Zone and Mascarene Belt to the Decade of North American Geology (DNAG) publications. A.A. Ruitenberg contributed to DNAG by preparing overviews on granitoid-related deposits, gold deposits, and redbed copper deposits in New Brunswick.

L.R. Fyffe, M.J. McLeod, and A.A. Ruitenberg prepared a field trip guidebook for the New England Intercollegiate Geological Conference (NEIGC) entitled "A Geotraverse Across the

St. Croix–Avalon Terrane Boundary, Southern New Brunswick." This guidebook also will be used for the 1992 Annual Meeting of the Geological Association of Canada in Wolfville, Nova Scotia.

A.A. Ruitenberg and L.R. Fyffe completed a report entitled "Characteristics and Tectonic Setting of Granitoid-Related Mineral Deposits in New Brunswick," which was published as Geoscience Report 91-1.

M.J. McLeod, A.A. Ruitenberg, and T.E. Krogh prepared a paper entitled "A Previously Unrecognized Lower Ordovician Volcanic Sequence in Southern New Brunswick: Evidence for Multistage Development of Iapetus?" that was presented at the 1991 Annual Meeting of the Atlantic Geoscience Society in Amherst, Nova Scotia. This paper was subsequently submitted for publication to *Atlantic Geology*. A.A. Ruitenberg and M.J. McLeod also prepared a paper entitled "Metallogenic Implications of a Newly Discovered Ordovician Island Arc Sequence in Southern New Brunswick." This paper was presented at a special session on "Mineralization in the Grenville Province and the Appalachians," which constituted part of the Annual Meeting of the Geological Association of Canada in Toronto. A.A. Ruitenberg presented a paper on the "Geology and Tectonic Setting of Some Precious Metal Deposits in Nevada and Idaho — Comparison with New Brunswick" at the March 7, 1991 meeting of the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum in Fredericton.

A.G. Pronk and A.A. Ruitenberg prepared a paper entitled "Applications of Surficial Mapping to Forest Management in New Brunswick," which was published in *Atlantic Geology*.

OTHER ACTIVITIES A.A. Ruitenberg continued to provide geological advice for forest site classification. Forest site classification is increasing in important because of the introduction of the single-arm harvesters for selective cutting and thinning. Lithologic compositions of surficial materials (regolith) can be used to predict nutrient potential of soils developed on various regolith systems. Other environment-related activities included the review and field checking of the hydrogeology of several sites proposed for regional waste disposal facilities in Kings and/or Westmorland counties and Albert County. Geologic advice was also provided to water-well drillers upon request.

Geoscientific Services Section

The Geoscientific Services staff, located at the Hugh John Flemming Forestry Centre in Fredericton, consists of Les Fyffe (Senior Geologist), Allen Seaman (Quaternary Geologist), A.G. Pronk (Geochemist), Valeria Vanicek (Geochemical Analyst), and Rex Boldon (Field and Laboratory Technician). Reg Wilson (Project Geologist) carried out a contract mapping project under the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD).

MAPPING PROJECTS Les Fyffe mapped the **bedrock geology of the Flume Ridge–Kedron Stream area** (NTS 21 G/6h and 21 G/7e) in Charlotte County to the west of the Mount Pleasant mine (Figures 5:7 and 6). The results of this survey have been digitized onto revised, 1:20 000 scale, computer-generated base maps, and will be published in 1992.

Reg Wilson mapped six 1:10 000 map areas (NTS 21 O/8-102, 8-103, 8-202, 8-203, 8-302, 8-303) in the **Halfmile Lakes–Little Bald Mountain area** of Northumberland County (Figure 5:8). The objective of the study is to gain a better understanding of the physical volcanic environment that favoured the formation of massive sulphide deposits in the Bathurst–Newcastle area. Concurrent structural studies are being carried out in the same area by Adrian Park of the University of New Brunswick's Geology Department and Jacob de Roo of the Geological Survey of Canada.

Toon Pronk is supervising the **collection of stream-sediment and water samples** from the Fosterville (NTS 21 G/13) and Fredericton (NTS 21 G/15) map areas of York County (Figure 5:9). Allen Seaman and Solweig Balzer, a graduate student at the University of New Brunswick, are **mapping and sampling surficial deposits** in the Canterbury map area (NTS 21 G/14) of York County (Figure 5:10). The objective of these geochemical projects is to locate anomalous metal contents along the contact of the Pokiok Batholith, an area favourable for the occurrence of Lake George vein-type deposits.

Figure 6. Diane Blair is collecting samples of slate near a reported fossil location on Cox Brook in the Flume Ridge–Kedron Stream area.

PAPERS/REPORTS Diane Blair continues to update the computerized (INMAGIC) and hard-copy files of the Bibliography of New Brunswick Geology maintained within the Mineral Resources Division. There have been approximately 500 new references added since the first publication of the bibliography in 1988 (Geoscience Report 88-1).

Cees van Staal of the Geological Survey of Canada and Les Fyffe prepared a manuscript on the geology of the Dunnage and Gander zones in New Brunswick for publication in the Decade of North American Geology (DNAG) volume, available as Geoscience Report 91-2. Art Ruitenberg and Les Fyffe completed a report entitled "Characteristics and Tectonic Setting of Granitoid-Related Mineral Deposits in New Brunswick" (Geoscience Report 91-1). Les Fyffe, Malcolm McLeod, and Art Ruitenberg prepared and led a field workshop for the New England Intercollegiate Geological Conference (NEIGC) entitled "A Geotraverse Across the St. Croix–Avalon Terrane Boundary, Southern New Brunswick." Les Fyffe and John Riva published a paper entitled "Revised Stratigraphy of the Cookson Group of Southwestern New Brunswick and Adjacent Maine" in *Atlantic Geology*. Les Fyffe and Scott Swinden (Newfoundland Department of Mines and Energy) published a review article entitled "Paleotectonic Setting of Cambro-Ordovician Volcanic Rock in the Canadian Appalachians" in *Geoscience Canada*. Allen Seaman and Bruce Broster (University of New Brunswick) published an article entitled "Glacigenic Rafting of Weathered Granite, Charlie Lake, New Brunswick" in *Canadian Journal of Earth Sciences*.

QUATERNARY GEOLOGY (Allen Seaman) A **Quaternary (surficial) geology and till geochemistry project in the southern Pokiok Batholith** (Figure 5:10) was begun during 1990 (Figure 7). This project was designed to complement the A-base-funded stream-sediment geochemistry investigation of the Pokiok Batholith area and the CAMD-funded bedrock mapping of the Lake George area, and to provide basic background environmental data on the Forest Planning Zone of the St. Croix International Waterway. Due to budget restrictions, the project operated at a reduced level in 1991. Ms. S.A. Balzer, an MSc student in the Geology Department at the University of New Brunswick, was able to complete mapping and sampling of the Canterbury (21 G/14) map area, begun in 1990, with some assistance from A.A. Seaman. Her thesis, following acceptance by the university in the spring of 1992, will be published by the Division, unedited, as an Open File Report. In addition to assisting with the work on the Canterbury area, A.A. Seaman carried out a limited mapping and sampling programme in the northwestern part of the McAdam (21 G/11) map area. The geochemical data for the Forest City (21 G/12) map area, mapped in 1990, will be released as an Open File Report. The Quaternary geology of the area will be released with that for the Fosterville (21 G/13) area, to be mapped in the near future.

Under the auspices of the Canada–New Brunswick Cooperation Agreement on Mineral Development, M.A. Parkhill completed the **surficial geology and till geochemistry mapping and sampling project** in the California Lake (21 O/8) map area (Figure 5:2). This project is a continuation of previous investigations in the adjacent Tetagouche Lakes (21 O/9), Upsalquitch Forks (21 O/10), and Nepisiguit Lakes (21 O/7) map areas, and ties in with a Geological Survey of Canada project investigating the surficial geology and till geochemistry of the Big Bald Mountain (21 O/1) and Serpentine Lakes (21 O/2) map areas.

Figure 7. Large blocks of Pokiok granite are a common feature of much of the area underlain by the Pokiok Batholith.

Figure 8. CANQUA conference participants examining marine bench sediments overlying the foreset beds of the Pennfield glaciomarine delta, east of the town of St. George.

During the first week of June, 1991, the University of New Brunswick, Fredericton, was host to the biennial meeting of the Canadian Quaternary Association (CANQUA). A.A. Seaman, with B.E. Broster and L.C. Cwynar (both of the University of New Brunswick), M. Lamothe (l'Université du Québec à Montréal), R.F. Miller (New Brunswick Museum), and J.J. Thibault (DNRE), organized the conference field excursion, which examined various aspects of the Late Quaternary history of southwestern New Brunswick (Figure 8). A.G. Pronk, acting as logistics coordinator, was instrumental in ensuring the success of the field excursion, while M.A. Parkhill assisted by driving one of the excursion vehicles. The field excursion guidebook will be republished by the Division. A.A. Seaman, in association with Pronk and Parkhill, also made a presentation at the conference entitled "Quaternary Geology of New Brunswick: Seven Years Later," which outlined the advances made in the understanding of the Quaternary geology of New Brunswick since the 1984 publication of Geological Survey of Canada Memoir 416, "Quaternary Geology of New Brunswick." At the same venue, S.A. Balzer and B.E. Broster made a presentation on "Glacial Dispersal of Clast Lithologies: Lake George Area, New Brunswick." B.E. Broster and A.A. Seaman also published a paper during the year on "Glacigenic Rafting of Weathered Granite: Charlie Lake, New Brunswick" in the *Canadian Journal of Earth Sciences*.

GEOCHEMISTRY LABORATORY (A.G. Pronk) Stream-sediment and water sampling over the Pokiok and adjacent areas (NTS 21 G/13 and 15; Figure 5:9) was completed in 1991. Publication of this data was delayed because of problems encountered in the production of appropriate base maps. Data from this project were already used by the Department of the Environment in its assessment of the quality of drinking water in the Harvey area.

Carboniferous geochemistry data and archived samples are being used by Dr. Dan Boyle of the Geological Survey of Canada in assessing natural variations in well water throughout the Carboniferous Basin.

All Provincial stream-sediment data from samples gathered between 1970 and 1983 were standardized by Rex Boldon. Although the data bases were in digital format, the data from different surveys and areas had different field sizes and orders. The data will be put on the Division's CARIS system.

A detailed stream-sediment and till sampling survey was carried out in the Halfmile Lake area (Figure 5:8) in cooperation with Mike Parkhill (Bathurst Office, CAMD) to provide base line geochemical data and assess glacial dispersal of ore material from the Halfmile Lake deposit.

At the Annual Meeting of the Atlantic Geoscience Society in Amherst, Toon Pronk presented a paper entitled "Geology and Environment: Earth First?" This paper was later transformed into a review paper for *Atlantic Geology* entitled "Geology and Environmental Change: a New Brunswick Perspective."

In early June, Toon Pronk co-chaired (with Dr. B.E. Broster, University of New Brunswick) the Canadian Quaternary Association's biennial meeting in Fredericton. The field excursion guidebook will be published as an Open File Report. The success of the meeting and

field excursions is attributed, in a large part, to the support given by several Mineral Resources Division staff members (Allen Seaman, Rex Boldon, Jacques Thibault, Gerry Johnson, and Dominique Bérubé). Some of the papers presented were later published in an *Atlantic Geology* special volume. Edward Hornibrook with Bruce Broster, Bill Gardiner, and Toon Pronk presented the study of heavy minerals in tills from the Todd Mountain–Trout Lake area of central New Brunswick (Open File Report 91-11). An outline of the application of surficial mapping to forest management was presented by Toon Pronk and Art Ruitenberg.

Edward Hornibrook followed up his work in the Todd Mountain–Trout Lake area with a similar study in the Millville area (21 J/3; Figure 5:11). This study will be published as an Open File Report.

Mining Week and Earth Day provided opportunities to promote earth science awareness in the communities of Campbellton and Fredericton and in schools (e.g., Devon Junior High and Fredericton High School). Several science fairs, showcases, and career days provided further opportunities to promote earth science awareness and the importance of the mineral industry to New Brunswick.

Mineral Deposits and GIS Section

The Mineral Deposits and GIS (Geographic Information System) Section staff consists of R.R. Irrinki (Senior Geologist), W.W. Gardiner (Mineral Deposits Geologist), G.W. Crouse (Drill-core Manager and MESP Coordinator), M.P. Rennick (Project Geologist, CAMD), and L. McNeill (GIS Operator, CAMD).

PROJECTS Rao Irrinki and Paul Rennick continued the computerization of drill-hole data on major metallic mineral deposits. The available drill-hole information on the Sewell Brook and Nash Creek deposits has been entered into the computer. Several sections have been generated for the Sewell Brook deposit.

The Geoscience Information System (GSIS) has three objectives: digital base-map maintenance, geoscience data compilation, and geoscience data integration. The system is mainly intended for internal use in order to efficiently meet the objectives of the Mineral Resources Division. It is hoped that the system will help to attract more exploration dollars to the Province and to promote environmentally sustainable development in the mineral resources sector.

Rao Irrinki, Laurie McNeill, Paul Rennick, and Terry Leonard (Policy, Planning, and Administration Branch) were carrying out the following GSIS projects in 1991: (1) base-map maintenance, (2) geoscience data compilation, (3) geological data maintenance, (4) geophysical data maintenance, (5) geochemistry data maintenance, (6) mineral occurrence data maintenance, and (7) mineral deposits data maintenance.

In coordination with Jacques Thibault (Mineral Development Branch), two pilot projects involving coastal zone mapping and peatland management are in progress. In cooperation with Fred Edney (Mineral Development Branch), a pilot project on a claim-tracking system using GSIS is also in progress.

Paul Rennick continued work on the geoscience data compilation for the **Antinouri–Nicholas project** (Figure 5:1). The data have been compiled for map sheets 21 O/16a, P/12e, and P/13d. Work on 21 P/12f, 12g and P/12b, 12c is in progress. He represented the Mineral Resources Division on the GIS Subcommittee of the New Brunswick Mapping Committee.

Bill Gardiner continued to work on mineral occurrences in the **Antinouri–Nicholas project** area (Figure 5:1). A total of 280 occurrences have been identified, with 223 being field checked during the 1990-91 field seasons. He also provided informal consultation to prospectors and mineral exploration companies.

Bill Gardiner updated the **New Brunswick computerized mineral occurrence data base**. Twenty-seven new occurrences (exclusive of Antinouri-Nicholas Project area) were identified by reviewing old and new assessment files and will be incorporated into the mineral occurrence data base. The updated data base will be released to the public every year. The development of a software package to manage this file was initiated. Release of the software is expected in 1992.

Greg Crouse coordinated the Mineral Exploration Stimulation Programme (MESP) and updated the drill-core and sample data bases. Thirty-nine applicants received MESP grants for 1991-92. To date, $65 000 has been given as MESP grants, and $10 000 was spent to conduct prospecting courses. The progress of this programme over the last three years is being reviewed.

PAPERS/REPORTS Rao Irrinki presented the following two talks: in March, a talk entitled "Geological Surveys Geoscience Information System Activities" was given at the Land Information Forum 91 held in Fredericton; in May, a talk on "Current GSIS Projects" was presented to the New Brunswick Geomatics Association meeting at Keddy's Inn, Fredericton. In September, Rao Irrinki attended a conference entitled "Computer Applications in the Mineral Industry" held in Vancouver, British Columbia.

Bill Gardiner presented a paper entitled "Coticules: significance to stratigraphic and metallogenic studies in the northern Appalachians," at the annual meeting of the Atlantic Geoscience Society in Amherst, Nova Scotia. He attended the Institute of Mining and Metallurgy Conference on "Prospecting in Glaciated Terranes," held in Edinburgh, Scotland, in August. He also attended the Society for Exploration Geochemists Conference, held in Reno, Nevada in April.

WORKSHOPS/PROSPECTING COURSES The GIS section organized two workshops on "GIS and Digital Image Analysis in Geology." Rao Irrinki organized a workshop entitled "Computer Applications in New Brunswick Mineral Industry" that was held in conjunction with the annual Review of Activities in November. More than 80 people attended the workshop, which included oral presentations by Division staff and representatives from the University of New Brunswick,

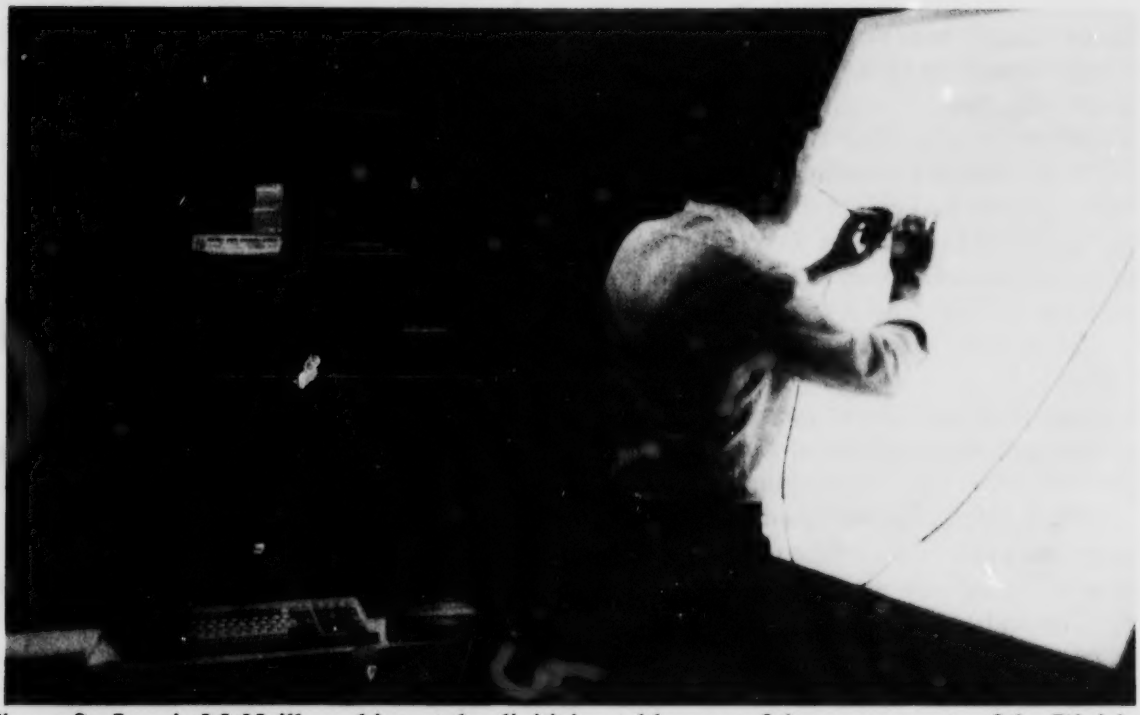

Figure 9. Laurie McNeill working at the digitizing table, one of the components of the Division's geoscience information system (GSIS).

Northeast Exploration Services Limited., and Geodat Information Services Ltd. Posters were displayed and computer applications and modelling were demonstrated.

Bill Gardiner conducted three prospecting courses in 1991. The first was a week-long course held at Perth-Andover (Figure 5:12) during the last week of March. Twelve people attended the course, which was sponsored by Indian and Northern Affairs Canada with instruction provided by the New Brunswick Department of Natural Resources and Energy. The second course was held in Fredericton on the weekends of May 31 and June 7. Fourteen people registered for this course. The third prospecting course was held in Bathurst where 10 people registered. The course was held on the weekends of June 14 and June 21. The Fredericton and Bathurst (Figure 5:12) courses were funded by the Mineral Exploration Stimulation Programme under the Canada–New Brunswick Cooperation Agreement on Mineral Development.

COMMITTEES Rao Irrinki represented the Mineral Resources Division on the Standards Committee, Mapping Subcommittee, and three working groups (Terminology, Future Entity Classification, and Spatial Referencing) related to geographic information.

GEOSCIENCE INFORMATION SYSTEM DATA BASES The Geoscience Information System has three objectives: digital base-map maintenance, geoscience data compilation, and geoscience data

integration (Figure 9). The system is intended mainly for internal use in order to efficiently meet the objectives of the Mineral Resources Division. It is hoped that the system will help to attract more exploration dollars to the Province and to promote environmentally sustainable development in the mineral resources sector.

Base-map maintenance: Mineral Resources staff and the mineral industry (prospectors, exploration companies, and mining companies) are extensive users of base maps, ranging in scale from 1:10 000 to 1:500 000. Currently, both staff and industry use mainly hard-copy maps derived from various provincial and federal government departments and agencies. Because computer-generated base maps were not readily available in the past, large sums of money have been spent to obtain nonstandardized maps derived from various projections and standards, and having varying degrees of accuracy.

The Province of New Brunswick recognized the need to standardize base maps by establishing the Land Registration and Information Service (LRIS) 1:10 000 scale maps as the Provincial standard base upon which all geographic information will be built. To further strengthen this concept, the Province established the New Brunswick Geographic Information Corporation (GIC), which has the mandate to create, maintain, and distribute base maps. At present, one needs a Geographic Information System (GIS) in order to use these standardized base maps, which are in digital form.

The Mineral Resources Division's Geoscience Information System (GSIS) is used to customize LRIS 1:10 000 digital base maps and then to create Resource 1, Resource 2, and Resource 3 types of hard-copy base maps. Resource 1 map series contains hydrography, four classifications of roads, contours at 10 m intervals and a few place names. The common scales are 1:10 000 and 1:20 000. All geology maps use this base. Resource 2 map series contains limited hydrography, two to three classifications of roads, and a few place names. The common scales are 1:50 000 and 1:250 000. All mineral claim maps use this base. Resource 3 map series contains most of the LRIS features except contours. The common scales are 1:10 000 and 1:20 000. This base is commonly used for Peat management, mining plans, reclamation plans, and groundwater assessment. At present, 600 out of 1885 maps are on the system. All these maps are from southern New Brunswick, but it is hoped that all the LRIS 1:10 000 digital files will be on the system by September 1993 — the expected date of completion by LRIS. The GSIS has been used to create customized base maps for all staff needs.

The Geological Surveys Branch obtained the 1:10 000 digital files at no charge by entering into agreements with the New Brunswick Geographic Information Corporation and the Land Registration and Information Service (Summerside, PEI). In return for the digital files, the Branch is providing LRIS with merged files created by GSIS.

Merging of LRIS 1:10 000 files involves five steps. The first step is to write a programme to network the 1:10 000 files. The second step is to standardize the file transfer routines and media. Next, the files are processed by using the above networking programme that automatically corrects the majority of topological errors. The fourth and fifth steps involve manual editing of

the files coming out of the networking programme; the files are then merged to the required scale (e.g., 1:50 000).

By September, 1993, all (1885) LRIS 1:10 000 maps for New Brunswick should be cleaned and merged to 1:50 000 and 1:250 000 scales. These maps have been recommended for use in the maintenance of all resource information. Federal 1:50 000 and 1:250 000 maps will become obsolete.

Geoscience data compilation: Mineral exploration reports of work (assessment reports) are submitted to the Mining Recorder by mining companies and prospectors to maintain their mineral properties in good standing. They constitute a large body of data that the Division felt could be utilized more effectively in a compiled form. The geocompilation project began in response to mineral industry demands and as a result of the availability of this kind of data in other provinces and territories. The Geological Surveys Branch began by compiling the data for the California Lake (21 O/8) map sheet as a pilot project. This work was contracted out at a cost of $80 000. The data were published as one hundred and twenty-five 1:10 000 maps that include base, geology, geophysics, geochemistry, and annotation layers. Work-location maps at 1:50 000 scale were published as four maps consisting of the work done between 1950-59, 1960-69, 1970-79, and 1980 to present. The project was then extended to cover the Nepisiguit Falls (21 P/5) map area, costing an additional $80 000. The industry would like this coverage extended to most parts of New Brunswick (90 NTS sheets).

The geocompilation project maps were digitized into the GSIS pilot project when the computer system became available. All the hard-copy maps (120 or more) for the California Lake (21 O/8) map area were digitized by using the GSIS. The project was then extended to cover the Antinouri–Nicholas area (parts of 21 O/9, O/16, and 21 P/12, P/13) and the Nepisiguit Falls (21 P/5) map area. By using the Geographic Information System, the base map production costs ($110 000/map sheet) have been reduced significantly. The data bases produced using this system are more versatile and less expensive than traditional geocompilation maps.

Geological data maintenance: For the past 50 years, the staff of the Geological Surveys Branch have generated geoscience data as well as collected it from the Federal Government, academic institutions, exploration companies, and prospectors. The Branch manages this geoscientific data base mainly in its original hard-copy format. Only about 50% of the recorded data are actually presented in published reports; the other 50% are mostly in the form of field notes.

Most of the Geological Surveys Branch's geological maps have been published at scales of 1:15 840, 1:31 680, 1:50 000, and 1:250 000. In order to comply with Branch policies, the data have to be transferred to 1:20 000 scale for integration purposes. Because manual conversion of hard-copy maps to 1:20 000 scale is expensive and time-consuming, conversion using the GSIS is advantageous. Digitizing will take 8 to 12 hours per map. The geoscience data currently collected is being maintained on the GSIS system.

The following geology maps have been digitized: 21 G/7e; 21 G/14a, 14b, 14g, 14h; 21 G/11g, 11h; 21 G/15a, 15d; 21 G/16h; 21 O/8; 21 O/9h; 21 O/16a; 21 P/13d.

Geophysical data maintenance: Geophysical data are gathered mainly by the Geological Survey of Canada and published mostly as 1:50 000 scale maps. These data consist of airborne magnetics, airborne radiometrics, and airborne electromagnetics. Gravity data are available at wide intervals. Ground geophysical data are also available for various parts of New Brunswick. These data have been collected at a cost of several tens of millions of dollars and are essential in the interpretation of geology and exploration for new mineral deposits.

The following geophysical and remote sensing data have been acquired: (a) Ten layers of geophysical data (seven layers of radiometrics and total field magnetics, VLF quadrature, and VLF total electric field), and seven bands of LANDSAT5 for the California Lake (21 O/8) map area, Antinouri–Nicholas project area (parts of 21 O/9, O/16, 21 P/12, P/13), and Lake George project area (part of 21 G/14); (b) Gravity data for the California Lake map area; (c) Profile data for 10 layers of geophysics for the California Lake map area. The profile data have been contoured at various intervals and integrated with the other thematic layers.

The index for all available airborne geophysical (magnetic, electromagnetic, and radiometric) data is being compiled for the Province of New Brunswick and will be available in the near future. During the next two years, all the available geophysical data from the Geological Survey of Canada will be integrated into the GSIS system, a useful tool for maintaining valuable geophysical data.

Geochemistry data maintenance: The Geological Surveys Branch and Geological Survey of Canada cooperate in the collection of stream-sediment, water, soil, till, and rock samples as part of geochemical exploration. The samples are then analyzed for 20 to 30 elements (e.g., copper, lead, zinc, and mercury) and the data are published on geochemical maps. This geochemical data base is essential for monitoring the environment, forest site classification, groundwater management, and fish and wildlife habitat studies.

During the pilot project, the geochemical data for the California Lake (21 O/8) map area were integrated with the other data sets. The pilot project documented the data base structure in dBASE and INGRES. The data base is now retrievable both textually and graphically according to the user-defined criteria. The Branch also plans to integrate all the available geochemical data for New Brunswick and has applied for a grant from the Environmental Trust Fund to help finance this project. Geochemical data maintained on the GSIS would be available to a number of departments for various applications.

Mineral occurrence data maintenance: The data on more than 1125 mineral occurrences are maintained in the New Brunswick Computerized Mineral Occurrence Database, which is organized into four dBASE files (*DEPOSITS.DBF*; *ROCK.DBF*; *TPA.DBF*; and *REF.DBF*) and one text file. They describe the mineral deposit characteristics, rocks associated with the deposits, tonnage, and references, respectively. All these data have been converted to CARIS format. The

mineral occurrence data collected for the Antinouri–Nicholas project as well as from elsewhere in the Province are being integrated with data on the system.

Mineral deposit data maintenance: Drill-hole data (including tonnage data) on several major deposits are presently managed by four dBASE files that include information on location, deviation, assays, and geology. A special software package by Geostat Systems International Incorporated has been used to produce cross and longitudinal sections, plans, histograms, and to estimate reserves from the drill-hole data. This special software creates CARIS-compatible graphic files. To date, mineral deposit data on ten major metallic mineral deposits have been integrated into the system. All the data on more than 40 such deposits in the Province can be integrated into the system depending upon available resources.

Mining plan and reclamation data storage: The Mineral Development Branch receives and stores mining and reclamation plans for all developing mines. Most of these data are in hard-copy format and should be digitized for effective management.

Claim-tracking system (pilot project): The Mineral Development Branch records mineral claims staked in the Province by using a claim-tracking system that is managed by dBASE programmes. These claims are manually plotted on 1:50 000 and 1:250 000 scale maps in the Fredericton, Bathurst, and Sussex offices, where they are updated frequently. The programme is written in dBASE III Plus and is used in a single-user, IBM PC, or compatible environment. The system is managed mainly by *TAG.DBF*, *GROUP.DBF*, and *LICENCE.DBF*.

The present system is incapable of handling graphic files and requires duplication in recording claims. The conversion of all claims to digital format is under review.

Sand and gravel pit management: The data on sand and gravel pits are managed by a data base file using the WANG system. At present, the location of each pit is manually plotted on 1 inch equals 40 chain maps. Two or three weeks would be required to digitize all the available data on gravel pits for integration into the GSIS.

Coastal zone mapping (pilot project): The Mineral Development Branch has been collecting data along the coast stretching from Moncton to Campbellton. The data should be integrated with the GSIS for effective management of coastal resources.

Peatland management (pilot project): The data for more than 800 peat bogs in the Province are being managed by several dBASE files. A tremendous amount of base and thematic information is available for several of the bogs being developed for production. Both the textual data (dBASE files) and graphic data have to be integrated for effective management. We are presently working on a pilot programme.

Geoscience data integration: Geoscientists and engineers need access to all available geoscience data bases to efficiently carry out their duties in the management of New Brunswick's mineral resources. A number of data sets, described above, have been integrated into the

Geoscience Information System. They include base maps, compilation data, geology, geophysics, geochemistry, remote sensing, mineral occurrences, mineral deposits, mining, reclamation, sand and gravel, and mineral claims. When all the information has been entered into the GSIS system, it will be possible to retrieve data in various combinations and to plot the required layers with the pen plotter or by using the Tektronics screen dump.

Spatial analysis and modelling: Spatial analysis is used to transform GIS data sets into information suitable for a given purpose by combining data from multiple spatial data sets and performing spatial analysis techniques and modelling. For example, if an exploration company is looking for exploration targets, the data sets should contain geology, geophysics, geochemistry, mineral occurrences, and assessment data layers. Each data set will be weighted in comparison to the others, with the resulting data providing the target areas. The GIS will not be used immediately for spatial analysis and modelling due to limited availability of data sets. The analysis would be limited to project areas.

WORKSHOPS ON GIS AND DIGITAL IMAGE ANALYSIS IN GEOLOGY The Mineral Resources Division organized workshops for February 22–24 and March 14–16, 1991, to enable mining companies and Mineral Resources staff to become more familiar with the processing, analysis, and use of digital image and map data, and with the integration of data originating from various sources. The workshops involved both hands on experience and theoretical background information on geoscience information systems.

Representatives from Noranda Exploration Company, Limited, K.D.A. Whaley Consultants, the New Brunswick Prospectors and Developers Association, Three-D GeoConsultants Limited, Maritime Groundwater Inc., Geosleuths, and Mineral Resources staff attended the workshops. Eugene Derenyi (University of New Brunswick, Dept. of Surveying Engineering), Tim Perrott (Canada Centre for Remote Sensing), Mike Lodin (Geodat Information Service Ltd.), Paul Williams, Bryan MacEachen, and Steve Ralser (University of New Brunswick, Geology Dept.), along with Rao Irrinki, Paul Rennick, and Laurie McNeill (New Brunswick Department of Natural Resources and Energy, Mineral Resources) conducted the workshops.

The workshops, well received by attendees, demonstrated that an atmosphere of cooperation exists among geoscientists in industry, university, and government for the development of the Geoscience Information System (GSIS), digital data creation, and digital data sharing.

GEOSCIENCE FIELD DATA COLLECTOR (GEO-100) The Field Data Collector, a hand-held computer, was built by Advanced Systems Design Ltd. according to the specifications given by the Geological Surveys Branch and will be used for recording field data. It provides an economical means of collecting information needed for geoscience field surveys. The data sets are automatically date/time-stamped.

The Data Collector Terminal is small in size, hand-held, and powered by rechargeable batteries for up to 30 hours of use. The data memory and the clock/calendar are backed up by battery power so that information is retained even when the terminal is turned off. The terminal

is designed for use in adverse climatic conditions over a wide temperature range and does not have external cables or connectors that could corrode and cause unreliable operation. The terminal can be placed in its Interface Cradle where recharging takes place and where the transfer of field data to a host computer is performed. Separate date/time-stamped data sets can be constructed for up to 45 field sites. The data sets can be transferred to a host computer for subsequent processing by suitable software packages, such as spreadsheet programmes, data base programmes or GIS systems.

MINERAL OCCURRENCE INVESTIGATIONS AND COMPUTERIZED DATA ENTRY (W.W. Gardiner) A review of all new assessment files, a number of old assessment files, and miscellaneous department files has located references to a number of mineral occurrences that are not listed in the New Brunswick computerized mineral occurrence data base. These data are being compiled and will be entered into the data base (along with data on new occurrences from the Antinouri–Nicholas project area) for release in 1993. There will be approximately 150 new occurrences added to the file and approximately 150 other mineral occurrences will have been updated. Exact locations for these mineral occurrences are being determined and entered into the Province's GIS system for printout at any map scale and in conjunction with any other geoscience survey on file. A new subfile being added to the New Brunswick computerized mineral occurrence file will give a textual description of occurrences; information will be compiled from archived data and from data collected during site visits. The first occurrences to be added to the subfile will be those examined during the course of the **Antinouri–Nicholas project** (Figure 5:1). The subfile will eventually be extended to include all the occurrences in the Province. A reference file is also being compiled that will list sample numbers cross-referenced to the outcrop field notes, thin section descriptions and geochemical analyses that are also computer archived. A 1:12 500 sketch map is also listed in the subfile. These sketches use the 1:12 500 colour aerial photographs as a base and can be found in the hard-copy mineral occurrence files located in Fredericton, Sussex, and Bathurst. These hard-copy files also contain much of the data used to derive the textual descriptions. Available aerial photographs and orthophotographs are also listed. An additional interpretative section will probably be added to this subfile.

ANTINOURI–NICHOLAS MINERAL OCCURRENCE PROJECT (W.W. Gardiner) This Provincially funded project was initiated in 1990 in conjunction with bedrock mapping in the **Antinouri–Nicholas project** area (Figure 5:1). A total of 280 occurrences have been identified in the study area, 85 of which were previously included in the New Brunswick computerized mineral occurrence data base. These new occurrences have been entered into the mineral occurrence file. Field checking of 135 occurrences was completed in 1991 (for a two-year total of 177). The data will provide more accurate locations for the Province's Geographic Information System (GIS), new occurrences, and updated information on known occurrences for the computerized mineral occurrence file. Samples from many of the occurrences — from the mineralized zones and their host rocks — were collected to identify the genetic types and commodities present. Representative samples are being analysed by multi-element techniques, and thin and/or polished sections of the mineralized samples are being prepared to determine mineralogy, mineral textures and, where possible, paragenetic sequences of the mineralizing processes. The mineral occurrences have been tentatively classified as to type; the types are

described briefly below. Field work at each occurrence includes pin-pointing the location, sampling for multi-element analysis, slabbing and thin-sectioning, and describing the occurrence in order to fully understand its geological setting and geometry.

There are three types of vein gold occurrences in the area. Gold in Type A occurrences is generally contained in narrow quartz veins with associated pyrite, minor arsenopyrite and, locally, base metals. Type B veins are predominantly massive arsenopyrite–quartz veins. Type C veins are arsenic-free quartz veins where gold is contained within pyrite.

Gold occurrences related to mafic dykes can be divided into two categories: gabbro-related and diabase-related. In the former, gold-bearing sulphides occur as disseminations and in veins within a wide carbonate-altered Ordovician gabbro that is probably in tectonic contact with Elmtree mélange. The latter type generally contains gold associated with fine needle-like arsenopyrite crystals in quartz–carbonate veins along the margins of the dykes and, less frequently, within the dykes that intrude Silurian rocks.

There are two miscellaneous gold occurrences in which gold-bearing, fine-grained, acicular arsenopyrite is disseminated in Silurian grits to fine pebble conglomerates. They represent paleo-placer deposits.

Granite-related Mo-Cu-F-W-Sn ± Pb-Zn occurrences fall within the broad classification of porphyry molybdenum deposits. They occur both within the granites and within the surrounding contact metamorphic aureole. The granite-hosted occurrences are composed of disseminated and stringer sulphides with molybdenum predominating over copper. Fluorite, scheelite, and tin occur as minor (to locally important) constituents of some of these occurrences. The base metals predominate in the contact metamorphic aureole.

Vein/breccia/stratabound Cu-Ba-Pb-Zn-Ag occurrences are restricted to the eastern half of the Jacquet River graben. They are generally contained within breccias of various types and occasionally within limestone. The copper and barite may be present as disseminations, as veinlets (stringers), or may be contained in quartz veins within the breccias. The breccia types are currently under study. The bulk of the mineralization appears to be syn- to early postvolcanic in origin as indicated by associated agates in the veins and vesicles.

Vein Pb-Zn-Ag-Cu occurrences can be further subdivided into (A) Silurian-hosted and (B) Ordovician-hosted deposits. There are a few significant differences in these vein types, although their origins may be related. The association of fluorite and, locally, tin and tungsten with many of these veins may indicate a relationship to the Devonian granites in the area. The Keymet and Nigadoo deposits are of this type.

Vein/stringer Pb-Zn-Cu-Ag ± Sb ± F occurrences are found near the Rocky Brook–Millstream fault zone as stringers, veins, and lenses paralleling the main foliation. Occurrences peripheral to the zone occupy tensional features at 130–140° as part of a splay fracture system related to the shearing. Minor gold, arsenic, and green fluorite are present in these occurrences.

Skarn base-metal and/or iron (stratabound) deposits occur within limestones or calcareous argillites that have been contact metamorphosed by the Antinouri Lake and Nicholas Dénys intrusions to coarse-grained calc-silicate assemblages and porcelanites. In many of these deposits, the iron occurs as coarsely banded magnetite. The base metals, tungsten, and molybdenum cross-cut the iron and are clearly related to the granites in the area.

Ophiolite-hosted Cu occurrences are primarily copper-bearing sulphide lenses and disseminations in ophiolitic basalts. No work was done on these deposits in 1991.

Mafic/ultramafic Ni-Zn-Pb-talc-asbestos occurrences have been recognized for a number of years, but their relationship to altered mafic/ultramafic allochthonous slabs has only recently been observed. The mafic/ultramafic bodies are generally conformable to the host Ordovician metasediments and strike 060–080°. Base-metal mineralization appears to be confined to the margins of the bodies, whereas the nickel is both within and marginal to them. The ultramafic slabs are highly bleached and altered. Gold and antimony enrichments are localized. Talc, serpentine, and poor-quality asbestos are found in some altered peridotites.

Red manganiferous shales (RMS) in the Ordovician Fournier Group are useful in determining the potential stratigraphic positions of massive sulphide deposits because they are enriched in many metals. At least one has elevated gold values associated with it.

Several massive sulphide occurrences are found in Tetagouche Group rocks along the southern margin of the map area. These stratiform sulphide occurrences contain banded pyrite, Cu, Pb, Zn, and Ag. The Orvan Brook and Rocky Turn deposits are of this type.

Miscellaneous or unclassified occurrences are generally base-metal deposits on which insufficient data have been collected.

ANTINOURI–NICHOLAS GEOSCIENCE DATA COMPILATION PROJECT (Paul Rennick) This CAMD-funded project, now in its second year, is a continuation of geoscience data compilation that has been ongoing since 1984. It is being carried out in conjunction with geological mapping and mineral occurrence studies in the Antinouri Lake–Nicholas Dénys area, northwest of Bathurst (Figure 5:1). Data have been compiled for map sheets 21 O/16a, 21 P/12e, and 21 P/13d. Compilation is in progress for map sheets 21 P/12f, 12g and 21 P/12b, 12c.

Graphic and textual data are being compiled at a scale of 1:20 000 in coordination with both the geological mapping and mineral occurrence studies in progress. When compiled, the data are input to the CARIS-based Geoscience Information System (GSIS).

Geoscience data compilation includes data collection, compilation, conversion–integration, and storage. The data are collected by 1:20 000 map area, and compiled onto graphical layers with associated thematic data bases. For each 1:20 000 map, data are divided into six thematic layers starting with the topographic base map. The base maps used are digital 1:50 000-scale bases obtained from Energy, Mines and Resources Canada. The remaining graphical data are

digitized from compiled hard-copy maps into thematic digital layers that overlie the existing base map.

The geoscientific data are divided into four thematic layers consisting of geological (including diamond drilling) surveys as layer two; geophysical surveys as layer three; geochemical surveys as layer four; and a fifth annotation layer composed of duplicate, replicate, and poorly located data from layers 2, 3, and 4. The final thematic layer consists of mineral exploration assessment work locations that are obtained from 1:50 000 NTS bases.

The data bases used for this project follow the form of those initiated for the compilation project for map sheet 21 P/5. Five data bases containing information on GEOSCAN, geological surveys, geochemical surveys, geophysical surveys, and airborne geophysical surveys were used to record the thematic data sets. Data bases containing information from diamond drilling, modelled after those used in mineral deposit studies, were also created for each map sheet. These four data bases contain information pertaining to drill-collar location, drill-hole deviation, assay-interval information, and lithologic-interval information.

MINERAL EXPLORATION STIMULATION PROGRAMME (G.W. Crouse) The Mineral Exploration Stimulation Programme (MESP) provides financial assistance to mineral exploration companies and prospectors who would like to carry out exploration for minerals within the Province of New Brunswick. These Provincially funded grants are available to anyone holding a valid Mineral Resources Division prospecting licence. They can be used to fund expenses such as analyses, meals, and mileage. Wages are not eligible expenses. A committee comprising L.R. Fyffe (Senior Geologist in Fredericton), W.W. Gardiner (Mineral Deposits Geologist), S.R. McCutcheon (Regional Geologist in Bathurst), A.A. Ruitenberg (Regional Geologist in Sussex), D. Hoy (representing the New Brunswick Prospectors and Developers Association), and G. Crouse (MESP Coordinator) reviews the MESP applications and approves those that meet the criteria.

When a MESP grant has been approved, 35% of the grant is awarded on approval. The recipient must submit a brief statement outlining how the initial 35% was spent before receiving the second installment of 35%. To receive the final 30%, sample location maps, analytical results, and travel logs must be submitted. Receipts for any purchases or expenses claimed under MESP must also be submitted. If an individual does not complete his programme and does not return unused funds he is not eligible for another grant until he does so.

The Mineral Exploration Stimulation Programme has been very popular since its inception in 1988, and each year a number of properties funded by MESP have been optioned to exploration companies.

The MESP committee met in early June, 1991 and reviewed 47 applications for grants. Thirty-nine applications were approved for a total of $65 000. Recipients included Gerald Alcott, Robert Baxter, Donald Black, Earnest Brooks, James Burns, Fred Cady, Wayne Carroll, William Carter, Peter Coakley, Robert Connor, Reg Cox, Jean Deschenes, William Donovan, Lee Fraser, William Gates, Pius Gaudet, Vital Gaudet, Donald Graham, Ian Graham, Clifford Griffin, Barry

Hachey, Owen Hickey, Donald Hoy, Bruce Jack, Delbert Johnston, James Kelly, Raoul Lagacy, Charles MacDonald, Patrick Marr, Timothy Mills, David O'Neil, Gaston Paulin, Norman Pitre, Walter Sharpe, Beverly Stewart, Ralph Stewart, Michael Taylor, Michael Trapnell, and Claude Willett.

Two prospector training courses were funded by MESP ($10 000). Ten people attended the course in Bathurst and fourteen attended in Fredericton (Figure 5:12).

DRILL-CORE MANAGEMENT PROGRAMME (G.W. Crouse) The Geological Surveys Branch maintains drill-core storage facilities in Fredericton, near Bathurst, and near Sussex (Figure 5:13). The Bathurst facility, located approximately 30 km north of Bathurst at Madran, was built in the mid 1970s under a Canada–New Brunswick Department of Regional Economic Expansion programme. The Sussex facility, located behind the Regional Office at Picadilly, was built in the 1980s under the Canada–New Brunswick Mineral Development Agreement. The Fredericton core-storage facility was built as part of the Hugh John Flemming Forestry Complex in the late 1980s. The Fredericton facility has a large well-lit viewing and sample preparation room that has been used almost continuously by company and government geologists since it was opened. Logging and sampling of the drill core from the Sewell Brook and Captain North Extension deposits was carried out at the Fredericton facility. The Geological Surveys Branch has also been using the facility to conduct a heavy-mineral-separation programme using gold wheels. The field geologists working out of the Fredericton Office also use the facility to prepare their samples. Anyone can use the facilities, the only stipulation is that they must keep the area clean and provide their own saw blades.

The Geological Surveys Branch received 35 583 m of core during 1991. In Bathurst, 16 483 m was donated by Corona Corporation and 9040 m was donated by Marshall Minerals Corp. In Sussex, 10 060 m of core was collected from the Lake George antimony mine site.

Inventories were conducted at the Fredericton and Madran core-storage facilities. Data bases listing drill core stored by the New Brunswick Department of Natural Resources and Energy and drill-core information submitted in assessment files were updated. Numerous companies have used the drill-core storage facilities in the three regions to log and sample core.

Geoscientific Editorial Services Section

Staff of this section include Barbara M.W. Carroll (Geoscience Editor), Shasta A. Abbott (Assistant Geoscience Editor, CAMD), and Kim Stewart (Report Typist, CAMD).

The Geoscientific Editorial Services Section is responsible for editing scientific reports and maps prepared by Division staff. From time to time, the Division also accepts for publication reports prepared by individual geologists or scientists from other organizations. If requested by

the project supervisor, scientific reports received in fulfilment of contract work are edited. In 1990, approximately 25 reports and 80 maps were edited and/or prepared for publication.

MINERAL DEVELOPMENT BRANCH

The Mineral Development Branch is composed of the Director's office, occupied by George J. Greer, and four sectors: Nonmetallic Minerals, Process Engineering, Mine Engineering, and Mineral Lands (Figure 1d). In 1991–92, the Branch had A-base budget expenditures of $630 181 and a staff complement of 11.4 full-time equivalents.

The Mineral Development Branch is responsible for all activities relating to the allocation of mineral rights under the Mining Act and the Quarriable Substances Act; to the utilization of the minerals and quarriable substances in accordance with maximum extraction techniques both in the mining and beneficiation, and to the proper reclamation of the disturbed lands. These activities include monitoring the prospecting, exploration, and development stages of the resources as well as scrutinizing production and reclamation plans and promoting further processing within the Province. The Branch is concerned with the administration of the following Acts: Mining Act, Quarriable Substances Act, Ownership of Minerals Act, and the Metallic Minerals Tax Act. As well, the unit is responsible for carrying out decisions under the Peat Policy, Potash Exploration Policy, and Coal Policy. All activities of the Branch are centralized in Fredericton.

The Nonmetallic Minerals Sector monitors the removal of aggregate materials and peat from Crown lands by issuing permits, exploration licences and leases, and by conducting inspections of the sites on a periodic basis. There were 240 quarry permits, 8 quarry leases, 3 peat licences, and 29 peat leases outstanding in 1991. A number of studies were carried out in this sector including the aggregate resource programme and the coastal mapping programme.

The Process Engineering Sector was involved in the ongoing study with respect to further processing options available to the Province, namely the ferric chloride leach process, the Sherritt-Gordon pressure leach process, and the Imperial Smelting process. As well, the sector monitored the administration of various programmes under the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD).

The Mine Engineering Sector continued to monitor the mining and reclamation activities of the mining operations in the Province. Three feasibility reports were reviewed as well as several submissions under the Environmental Impact Assessment Regulation of the Clean Environment Act.

The Mineral Lands Sector monitored prospecting and exploration activity by recording 4571 claims in 1991, up 5% from the 1990 total of 4361 claims. At the end of the year, there were 21 350 claims, 6 coal agreements (5976 claim equivalents), 3 potash leases (2382 claim equivalents), and 16 mining leases (931 claim equivalents) in effect, which represent a total claim equivalent of 30 639 (down 1% from 1990).

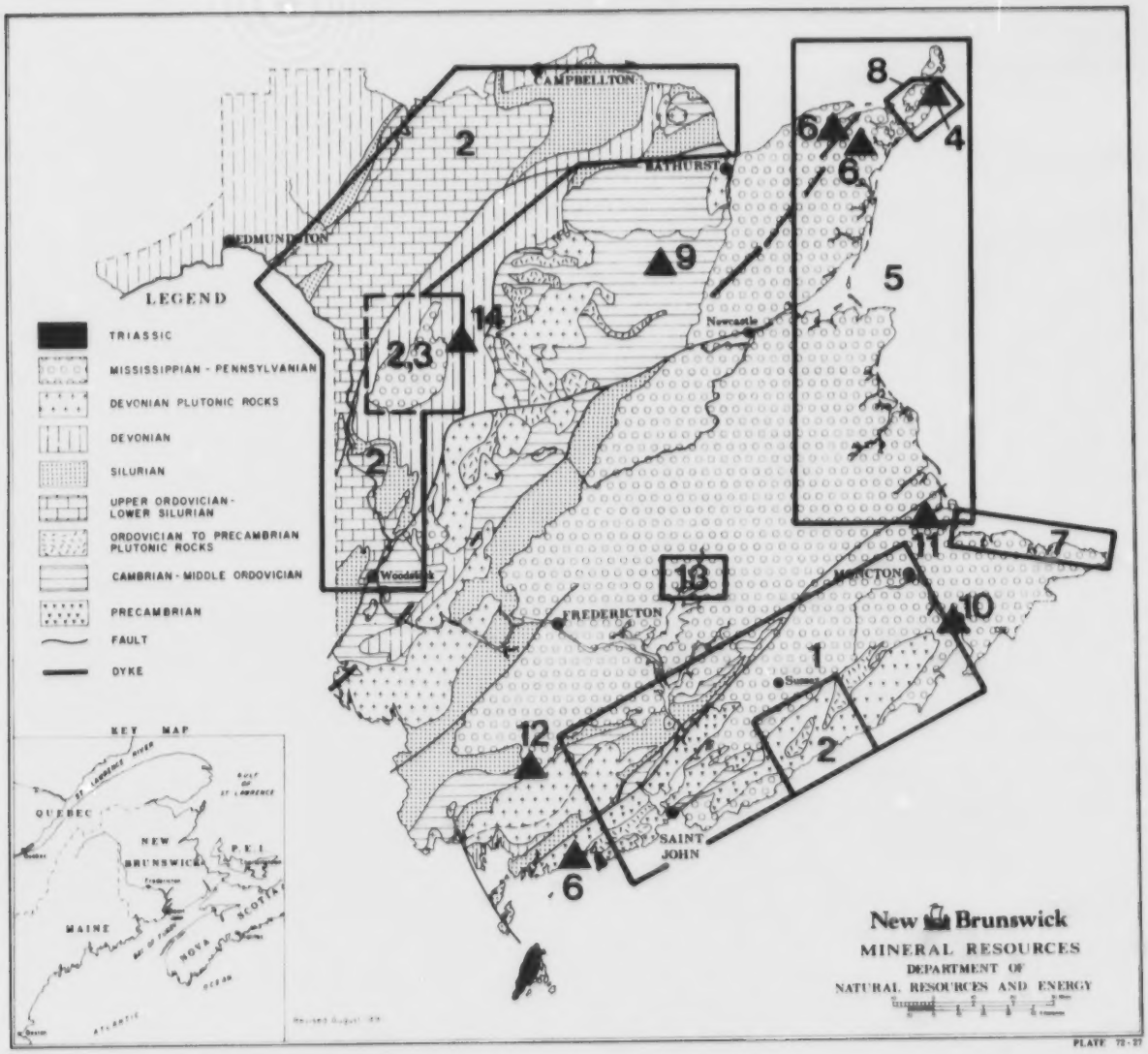

Figure 10. Areas in which Mineral Development Branch projects were conducted in 1991: (1) Limestone resource inventory (Prov.); (2) Preliminary regional evaluation of bedrock aggregate (Prov.); (3) Plaster Rock Basin study (Prov.); (4) Siltation pond monitoring, Bog 567 (CAMD); (5) Survey of abandoned mine sites on peatlands (CAMD); (6) Peat moss filter beds demonstration sites (Prov.); (7) Coastal mapping (Prov.); (8) Shoreline study (Prov.); (9) Heath Steele waste-rock study (CAMD); (10) Boudreau sandstone quarry (CAMD); (11) Bastarache sandstone quarry (CAMD); (12) Mount Pleasant tin–molybdenum–indium (CAMD); (13) Minto waste coal study (CAMD); (14) Metallurgical assessment of Sewell Brook ore (CAMD).

Nonmetallic Minerals Sector

The Nonmetallic Minerals Sector consists of Timothy C. Webb (Industrial Minerals Geologist), D.V. Venugopal (Nonmetallic Minerals Geologist), Jacques J. Thibault (Peat and Coastal Zone Geologist), and Paul C. O'Leary (Engineering Technician, Sand and Gravel). Dominique Bérubé, Coastal Zone Geomorphologist, was hired under contract.

INDUSTRIAL MINERALS (Timothy Webb) Although administrative duties and funding constraints have limited time available for field work, several field-related studies are undertaken each year. In 1990, industrial mineral projects funded under the Division's A-base budget included studies pertaining to limestone, bedrock aggregate, and mineral inventory in selected regions.

It is becoming increasingly more important to identify provincial limestone deposits with respect to quality, reserves, and factors affecting potential development in order to confront anticipated market requirements of the future. As a move in this direction, the **limestone resource inventory project** is currently underway to re-examine and reassess the Province's limestone resource (Figure 10:1). The project consists of five main phases addressing such topics as the historical development and current status of the limestone industry, and practical geologic aspects of known deposits and occurrences.

Between 1988 and 1990 output of the limestone resource inventory has been restricted to the preparation of three draft reports and accompanying 1:10 000 scale maps on Precambrian, Silurian/Ordovician, and Carboniferous limestone deposits throughout the Province. This work has resulted in the setup of a computerized sample inventory and a deposit classification and rating scheme for various deposits as a means of qualifying future development potential. A report on Ordovician/Silurian deposits was completed in 1991 (Ordovician/Silurian Limestone Resources of New Brunswick — Open File Report 90-7). Reports on Carboniferous and Precambrian limestones are in the final pre-publication stages.

Dwindling reserves of granular aggregate, high transportation costs, tighter environmental regulations, and higher construction specification standards are among the factors influencing the increased viability of using bedrock as a source of high-quality aggregate in New Brunswick.

A lack of province-wide information pertaining to bedrock aggregate has been identified during the last few years. This has prompted the initiation of a programme designed to establish a data base of potential bedrock aggregate. In 1988, a pilot plant project was carried out that included a **preliminary regional evaluation of bedrock aggregate** in selected parts of the Province. The project was designed to reference and identify potential sources of bedrock aggregate in two selected areas: (1) Caledonian Highlands, extending from an area southwest of Moncton to the Saint John area; and (2) an area northwest of Fredericton (Figure 10:2). The selection of these areas was based primarily on projected high-demand and high-density activity requiring good-quality aggregate material.

Included in the study were a historical analysis of production-and-consumption statistics and identification of rock types favourably located as sources of high-specification aggregate. The purpose of this initial evaluation was to provide basic information on selected rock types pertaining to relevant engineering specification for user industries rather than to actually locate potential quarry sites. The investigation included selection and sampling of some 80 sites. Samples were subjected to specific engineering tests in order to establish evaluation criteria in identifying potential high-quality material.

During the summers of 1989, 1990, and 1991, the persistent increase in demand from consumers for high-quality aggregate led the Mineral Development Branch to undertake a sampling programme in selected areas of the Province. Several hundred samples have been collected. Relevant engineering tests have been carried out on most of these. To expedite the processing and reduce the costly contracting out of sample testing, an in-house quality testing laboratory has been established. The lab, operated by the Branch's Process Engineering Sector, is capable of performing standard ASTM tests for Los Angeles abrasion, soundness, density, and size gradation (Figure 11).

A review and assessment of the **geology and mineral resources of the Plaster Rock Basin and adjacent area** (Figure 10:3), Victoria County, was completed in 1991. Information was compiled and synthesized from various published and unpublished reports, and mineral exploration reports of work (assessment reports) that have been submitted to the Mineral Resources Division

Figure 11. Ivan Maranda is using a jaw crusher to prepare aggregate samples at the Mineral Development Branch's bedrock aggregate laboratory in Fredericton.

of the New Brunswick Department of Natural Resources and Energy. Additional data were acquired through field investigations carried out during 1990-91, followed up by laboratory studies. As a result, the report on this project provides new qualitative information pertaining to the region's gypsum and limestone deposits and its bedrock aggregate resources.

The report, entitled "A Preliminary Assessment of the Geology and Mineral Resources of the Plaster Rock Basin and Adjacent Area, Victoria County, New Brunswick," is intended as a general guide to the physiographic and geologic setting of the Plaster Rock Basin. Background information is provided on the basin's stratigraphy, structure, and surficial geology, as well as an inventory and preliminary assessment of the area's mineral resources. The mineral inventory contains details of the distribution, quality, quantity, and potential significance of the region's more notable mineral resources.

A recent revival of interest in the use of natural stone as a viable construction material as well as interest in the restoration and renovation of vintage stone buildings prompted the Department of Natural Resources and Energy to conduct a research project chronicling the history of the New Brunswick building stone industry.

The study, entitled "For Love of Stone," represents two years of very dedicated research by Gwen L. Martin. It is a two-part publication. Volume I gives a detailed account of the industry over time — its inception and prime, its decay and collapse, its potential future — and describes the people who helped to make New Brunswick stone famous. Volume II is an overview or catalogue of selected stone buildings and structures in the province, and is divided into five sections: public buildings, churches, private residences, commercial buildings and bridges/monuments. The building catalogue is designed to supplement Volume I, and also to serve as an independent reference text for designers, heritage planners and others who need information on provincial stone architecture.

PEAT (Jacques Thibault) Applications continued to be received for Peatland Exploration Licences.

The results of a hydrological survey of Bog 569 at Pigeon Hill were published as Open File Report 91-10. Another project was initiated to study the **effectiveness of ponds in controlling suspended solids in the drainage from a peat operation (Bog 567)** north of Coteau Road (Figure 10:4). The project is carried out under contract by GEMTEC Limited of Fredericton and a report will be published in early 1993.

A survey of the **extent of abandoned mine sites on peatlands** (Figure 10:5) was carried out under contract by Three-D GeoConsultants Limited of Fredericton.

A project was undertaken to demonstrate the **effectiveness of peat moss filter beds** for the treatment of domestic wastewater. Peat systems were installed late in 1991 at three localities in the Province (Figure 10:6). Monitoring of the effluent will continue until the end of 1992.

Results of the project will be published early in 1993. The work is carried out under contract by the Peat Research and Development Centre of Shippagan.

COASTAL ZONE (Jacques Thibault, Dominique Bérubé) Coastal mapping continued along the Northumberland Strait at the scale of 1:10 000. Field work was carried out between Cape Tormentine and Shediac (Figure 10:7). Preliminary results of the mapping programme were presented by Mr. Bérubé in Montréal at the Annual Meeting of AQQUA (Association québécoise pour l'étude du Quaternaire).

Shoreline investigations were also carried out in Miscou Harbour and around Lamèque Island (Figure 10:8).

Process Engineering Sector

In 1991, the Process Engineering Sector consisted of Robert Harris, P.Eng. (Process Engineer), David Plante, P.Eng. (Project Engineer, CAMD), and Mitch O'Donnell (Engineering Technician, CAMD). In January, 1992, Mr. Harris will be leaving the Branch and Mr. Plante will assume his duties.

The Process Engineering Sector is responsible for providing specialist input for the administration of the Mining Act and the Metallic Minerals Tax Act. In accordance with the terms and provisions of these acts, this sector reviews feasibility reports and reports on research and development projects pertaining to existing and proposed operations. The sector is also responsible for identifying and assessing mineral processing opportunities with the objective of promoting development of the Province's mineral industry. The management of the activities/studies under the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD) is largely the responsibility of this sector.

The following studies were carried out during 1991, either under the provincial A-base budget or with funding from the CAMD:

Further processing of base metals – technical support: This project, provincially funded (A-base), was a review of lead/zinc base-metal processing technology, potentially applicable to New Brunswick. It was completed in 1991. A report on a preliminary technical and economic comparison of the most promising processing options was written. Hydrometallurgical processes that potentially can treat low-grade bulk concentrates were identified as having good potential for in-province application. Subsequently, technical support was provided to the Interdepartmental Committee on Base Metal Processing (ICBMP) in their review of opportunities and constraints for further processing.

Supported liquid membranes: This provincially funded (A-base) study was initiated in 1990 and completed in 1991. It was carried out by R. May & Associates of Fredericton, utilizing

the laboratory facilities of the Department of Natural Resources and Energy. Supported liquid membranes (SLM) are a relatively new technology, conceptually similar to solvent extraction, used to remove dissolved species from process streams. This approach was offered as a possible way of recovering dissolved base metals from tailing streams. The final report, entitled "A Preliminary Evaluation to Determine Whether Supported Liquid Membrane Technology is a Viable Technique to Recover Metals from Acid Mine Drainage," is available as Open File Report 91-15.

Assessment of treatment options for base-metal sulphide tailings: This CAMD-funded study was approved in 1991. It is to examine the merits of reprocessing the huge inventory of base-metal tailings in the Province for increased resource utilization and to address the looming environmental concerns. This is being proposed as an alternative to using covers and long-term water treatment practices.

Heath Steele Waste Rock Study — Phase IV: This is a CAMD-funded study that was approved in 1991. It involves the field testing of the natural soil cover (identified in Phases I, II, and III) for the waste rock piles at Heath Steele (Figure 10:9). The test piles are to be monitored via specialized instrumentation for this application. The results will allow for the development of design data to effectively construct covers for these piles.

MINERAL INVESTMENT STIMULATION PROGRAMME (MISP) MISP is an initiative that was created under the Canada–New Brunswick Mineral Development Agreement (MDA, 1984-89) to provide direct, private sector assistance for projects that could result in the development of the Province's mineral resources. MISP has been continued under the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD, 1990–1995). A total of $775 000 has been allocated to the programme over the five years of the agreement. Up to 50% of a project's eligible costs, to a maximum of $30 000, can be funded. Eligible project areas include geological investigations, mining and processing studies, environmental investigations, and promotional studies.

In 1991, nine projects were approved for MISP funding. Two projects involved geological/processing investigations of the **Boudreau sandstone quarry** (Figure 10:10). This quarry was the site of a significant operation in the early 1900s. A resurgence in the demand for high-quality stone and technological advances in quarrying and finishing has led to a consideration of reopening this quarry. The first phase of the study identified a potential source of large blocks. The second phase, involving the testing of a quarry extraction method, is to be completed in 1992. Another project, on the **Bastarache sandstone quarry** (Figure 10:11), involved a geological investigation to determine the quantity and quality of stone at that site.

Three projects were carried out to investigate the potential development of the **Mount Pleasant tin zones** (Figure 10:12). The tin zones are estimated to include reserves of more than 5 000 000 t of ore grading 0.72% tin. Recovery of rare minerals, particularly indium, could also have a significant impact on the feasibility of developing this site. The first project involved a mineral processing study to define a potential method of beneficiating the ore to produce marketable concentrates. Based on these results, a preliminary feasibility was done that included

a study of preliminary capital and operating costs and a mining study. The third project, which will be completed in 1992, involves an assessment of the indium reserves, based on existing core samples.

A laboratory project investigated acidic bioleaching as a method to recover copper from the secondary sulphide sands at Murray Brook. This approach has been used successfully in Chile, but significant modification was required for the Murray Brook copper ore and the New Brunswick climate. Laboratory results indicated 80% recoveries over four months. MISP also provided assistance for a laboratory study of a ferric chloride leaching (FCL) process for the St. Stephen nickel–copper–cobalt deposit. This study ultimately led to the construction of a mini-pilot plant.

MISP also provided funding for projects that could potentially have a positive impact on the environment. One project involved a study of marketing **waste salt from a potash operation**. Similarly, another project investigated the **utilization of waste coal from Minto** (Figure 10:13).

MINERAL PROCESSING INVESTIGATIONS PROGRAMME (MPIP) MPIP is an in-house activity, funded through the Canada–New Brunswick Cooperation Agreement on Mineral Development, that utilizes the provincial mineral processing laboratory located in the Ancillary Building of the Hugh John Flemming Forestry Centre. The purpose of MPIP is to generate the processing data on provincial mineral resources that are required for development purposes. The work for 1991 involved two projects.

One project, the **metallurgical assessment of selected deposits**, involved beneficiation of the Sewell Brook base-metal ore (Figure 10:14). Basic processing limits of this resource were defined. The other project, **testing of in-province aggregates**, was a continuation of a project from the previous year. The engineering properties of more than a hundred aggregate samples from the Saint John and Bay of Fundy regions were defined.

Mine Engineering Sector

The Mine Engineering Sector consists of Samuel K. McEwan, P.Eng. (Mining Engineer) and Robert Butler, P.Eng. (Reclamation Engineer).

The sector is responsible for work of both a specific and general nature relating to the mining industry of New Brunswick. Responsibilities include the monitoring of mining activities; compilation and analysis of mining statistics; administration of the Mining Act; review and evaluation of feasibility reports, annual mining plans, and reclamation reports; and administration of projects funded by the Canada–New Brunswick Cooperation Agreement on Mineral Development (CAMD). In addition to these specific tasks, the Mine Engineering Sector liaised with the Federal government and other provincial governments on matters related to the mining industry.

Sam McEwan continued to monitor the mining and reclamation activities of the mining operations in the Province. A number of mine plans, received in compliance with the Mining Act (Section 25, Regulation 86-98), were reviewed; three feasibility reports and several submissions under the Environmental Impact Assessment Regulation of the Clean Environment Act were also reviewed. During the year, the final review of Stratabound Minerals Corp.'s feasibility for development of the Captain North Extension (CNE) deposit was carried out. In addition, a preliminary feasibility study for the mining of the Mount Pleasant tin–molybdenum–indium deposit was reviewed.

The staff of this sector continued to work closely with the Department of the Environment on the aspects of mining that may have an impact on the environment. Reclamation and/or Environmental Impact Assessment (EIA) reviews were conducted for the East West Caribou Mining Limited mining lease, the Murray Brook mine's copper deposit, Stratabound Minerals Corp.'s CNE lease, Brookville Manufacturing Company's Acamac property, the APOCAN reclamation plan, and the Gordex Minerals Limited silica deposit. In addition, extensive work was conducted to ensure that a comprehensive alternate plan of action was in place for the East West Caribou Mines Limited environmental–reclamation obligations.

Site inspections were made regularly to verify compliance with approved reclamation plans and operating permits.

COMMITTEES Sam McEwan is a member of the Federal–Provincial Committee on Mineral Statistics, which coordinates the efforts of Energy, Mines and Resources Canada and the provincial governments in the timely collection of relevant mineral statistics, while minimizing the inconvenience to the respondent. Sam McEwan and Robert Butler are members of the Inter-departmental Standing Committee on Mining and the Environment, which was established in 1989. The committee meets regularly during the year to address issues dealing with mining and the environment. Sam McEwan and Robert Butler also represented the Department on the Management Committee and Technical Working Group, respectively, of the Mine Environment Neutral Drainage (MEND) programme. MEND, a cooperative programme involving industry and the Federal and provincial governments, has the mandate to research technologies for preventing and treating acid mine drainage. The Technical Working Group reviews programmes to be initiated by industry and members who manage and attempt to prevent acid generation from sulphide-bearing mine waste. The Management Committee coordinates and reviews proposals from the technical committees and prepares recommendations for the Board of Directors to consider.

CONVENTIONS In September, 1991, Sam McEwan and Bob Butler attended the Second International Conference on the Abatement of Acid Drainage held in Montréal, Québec.

RECLAMATION (Robert Butler) In 1991, the reclamation plan for the CNE mine (Stratabound Minerals Corp.) was approved. Reclamation plans for three exploration development projects were also approved.

N.B. Coal Limited disturbed 150 ha of land in 1991, and has reclaimed 250 ha. Other mining companies also have maintained their reclamation on disturbed land in accordance with their approved schedules.

The Province has provided financial assistance and technical support on various reclamation and rehabilitation programmes. An example is the support given to Brunswick Mining and Smelting Corporation Limited for Phase IV of the **Heath Steele waste-rock study** (Figures 10:9). This project is designed to investigate the capping of waste-rock piles to lower or prevent acid generation.

Mineral Lands Sector

Mineral Lands staff in 1991 consisted of E.V. Jackson (Mining Recorder); F.J. Edney (Deputy Recorder); and P. Evans (Cartographic Technician).

The Mineral Lands Sector processes and maintains records pertaining to the disposition of Crown-owned mineral rights. Prospecting licences are sold in Fredericton and at the regional offices in Bathurst and Sussex. During the year, 4571 claims were recorded at these offices (Table 2). Individuals or companies with intentions to carry out exploration work in the Province must complete Form 18 (for privately owned land) and Form 18.1 (for Crown lands). They are available from the Division's Fredericton, Bathurst, and Sussex offices.

Mineral exploration reports of work, submitted to the Mining Recorder's office in accordance with the Mining Act, are checked for compliance with all regulations. Upon acceptance, they are given to the Geoscience Data Section for GEOSCAN indexing, microfilming, and storage.

Amendments to the Mining Act in 1991 clarify that shale used to make brick and tile products and limestone used to make cement are minerals. Provisions with respect to temporary housing are clarified.

Statistics on expenditures reported for assessment credit are available from two sources. The Division compiles statistics from mineral exploration reports of work submitted in accordance with the Mining Act; Energy, Mines and Resources in Ottawa compiles statistics from information submitted to them in compliance with the Statistics Act (Figure 12). Table 2 and Figure 13 present the Division's mineral lands and exploration statistics for 1991.

MINE TAXATION

Reporting to the Director of Financial Services, the Mine Assessor, Wayne R. Carr, is responsible for the collection of all revenue due the Province from mineral taxation and royalties.

TABLE 2. MINERAL LANDS AND EXPLORATION STATISTICS, 1991

Mineral Lands (total in effect at year's end unless specified for 1991)	No.	Claim Equivalent	Hectares	% Inc. Over Prev. Year* (Dec.)
Prospecting Licences	908	-	-	7
Claims Recorded, 1991	4 571	-	73 136	5
Claims Renewed, 1991	17 455	-	279 280	11
Claims Expired, 1991	4 549	-	72 784	(1)
Claims in Effect	21 350	-	341 600	(2)
Coal Agreements	6	5 976	95 616	N/A
Other Agreements	-	-	-	-
Potash Leases	3	2 382	38 112	0
Mining Leases	16	931	14 896	0.4
Total Claims and Claim Equivalents	-	30 639	490 224	(1)
Oil and Gas Licences	1	-	10 058.3	-
Oil and Gas Leases	4	-	13 289	0
Bituminous Shale Licences	-	-	-	-
Bituminous Shale Development Permits	-	-	-	-
Bituminous Shale Leases	1	-	1439	0
Underground Storage Licences	-	-	-	-
Underground Storage Leases	-	-	-	-
Quarry Permits	240	-	-	(24.5)
Quarry Leases	8	-	501.61	4
Peat Licences (issued 1991)	3	-	1 909	-
Peat Licences	3	-	1 909	8
Peat Leases	29		11 409	5

Exploration	Number	Length (m)	Value ($)
Assessment Reports	155		9 916 301
Drilling	216 holes	60 115	3 731 749
Potash Exploration Expenditure			-
Drilling	-	-	-
Oil-Gas Exploration Expenditure			-
Drilling	-	-	-
Bituminous Shale Expenditure			-

* Based on number of hectares, where applicable.

February 15, 1992

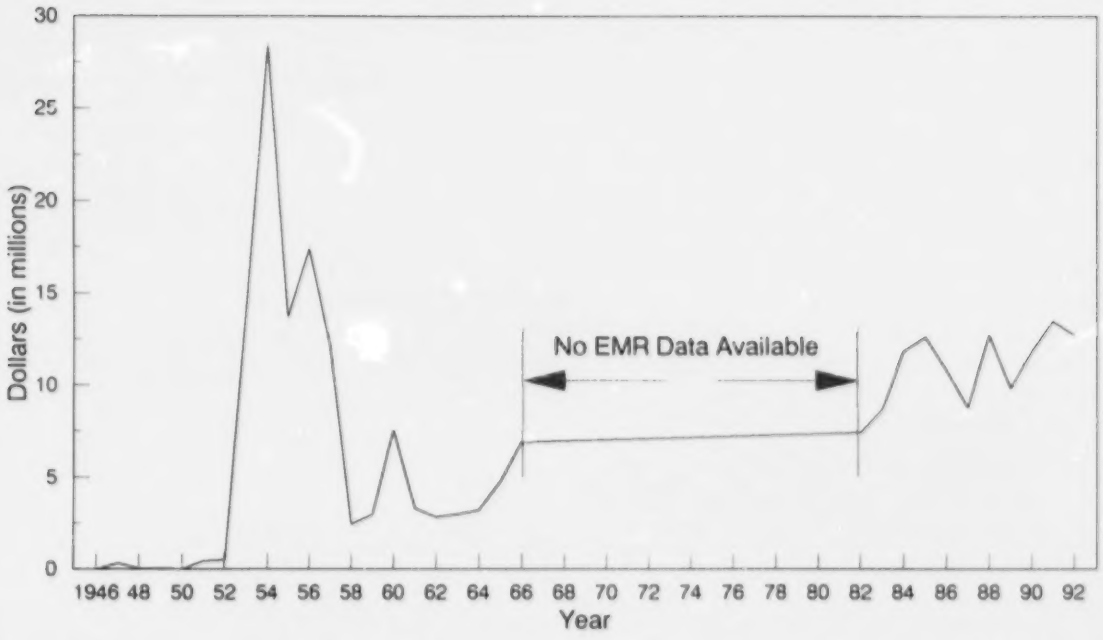

Figure 12. Total annual expenditures (general and mine-site exploration, no overhead) reported for assessment credit, 1946 to 1991. Source: Energy, Mines and Resources Canada. ($ 1986 = 100)

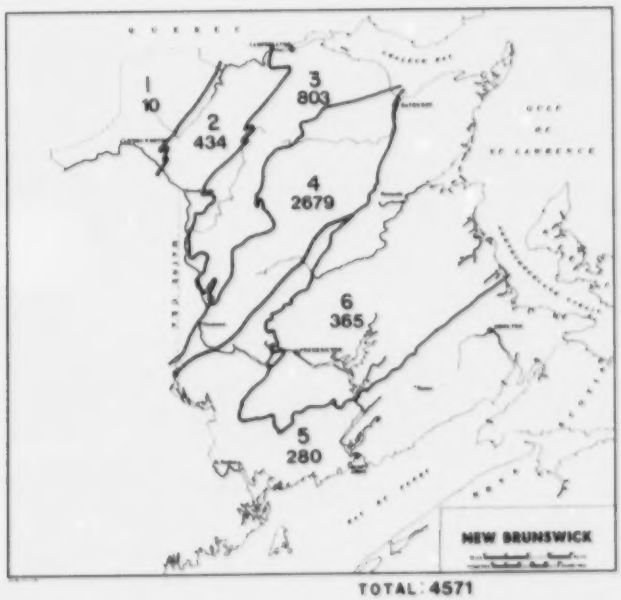

Figure 13. Number of claims staked by metallogenic region in 1991.

The Mine Assessor is responsible for the administration of various Acts as they relate to the collection of taxes and royalties due the Province, and is required to provide estimates for Central Government regarding the amount of revenue expected from each source. The Acts involved are: Metallic Minerals Tax Act, Mining Act, Quarriable Substances Act, Oil and Natural Gas Act.

The metal mines subject to the Metallic Minerals Tax Act are required to make monthly payments, based on an estimate of amount owing, and submit an annual tax return within six months of their year end. These annual returns are audited and additional assessments are issued as required. On-site audits as well as desk audits are conducted on companies subject to the Metallic Minerals Tax Act to determine compliance with the Act. On-site audits are also conducted on producers of other commodities to determine compliance of the appropriate acts.

Royalties are collected as follows: Monthly — coal, natural gas; Quarterly — potash, salt, oil; Semi-annually — peat moss, sand and gravel.

An annual conference is held for the Provincial Mine Assessors and Revenue Collectors to discuss matters of mutual concern associated with mineral taxation and collection.

MINING COMMISSIONER'S REPORT

M. Richard N. Renouf (P.O. Box 7, Florenceville, N.B. E0J 1K0; Telephone: 392-5506) is Mining Commissioner.

In 1991, there were no applications to the Mining Commissioner for hearings nor were there any hearings held. One decision was rendered in January, 1991 with respect to a hearing that was held in 1990.

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PLATES (See List of Publications for detailed listings)

Plate 71-56

Stream and spring geochemical index, to December 1987. (Revised, August 1991). Scale: 1:500 000.

Plates 90-152 to 90-154 (3 plates)

Geological compilation maps, southern New Brunswick. (21 G/9; 21 H/12, H/13). M.J. McLeod, S.C. Johnson, and A.A. Ruitenberg. (1991). Scale: 1:50 000.

Plates 90-163 to 90-172 (10 plates)

Millstream Mining Licence, Acad'or project: soil geochemistry and sections. (21 P/12). Lacana Mining Corporation. (1991). Scales: 1:5000 and 1:250. See Open File Report 90-9. (Canada–New Brunswick Mineral Development Agreement 1984-89).

Plates 91-1 to 91-3 (3 plates)

LAC–Billiton tin project: sections. (21 G/7). LAC Minerals Limited. (1991). Scale: 1:2500. See Open File Report 91-4. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plates 91-4 to 91-7 (4 plates)

Lake George antimony mine: surface plan and sections. (21 G/14). Dominion Explorers Inc. (1991). Scale: 1 inch equals 200 feet. See Open File Reports 91-6 and 91-8. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plates 91-8 to 91-11 (4 plates)

Lake George antimony mine: sections. (21 G/14). Dominion Explorers Inc. (1991). Scale: 1 inch equals 100 feet. See Open File Report 91-7. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plate 91-12

Lake George longitudinal section: showing gold values. (21 G/14). Dominion Explorers Inc. (1991). Scale: 1:1200. See Open File Report 91-8. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plates 91-13 to 91-23 (11 plates)

Elmtree project: drill hole/trench locations, Fraser filter contours, sections. (21 P/13). Corona Corporation. (1991). Scale: 1 inch equals 400 feet. See Open File Report 91-9. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plate 91-24

Crown Lands quarry sites, 1990 to date. New Brunswick Department of Natural Resources and Energy, Mineral Resources. (1991). Scale: 1:500 000.

Plates 91-25A to 91-25C (3 plates)

Surficial geology and geochemistry in north-central New Brunswick (21 O/9, O/10, O/15; parts of 22 B/1, B/2). A.G. Pronk and M.A. Parkhill. (1991). Scale: 1:100 000. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plate 91-29

Late Precambrian–Early Cambrian geology — St. Martins area, southern New Brunswick. (Parts of 21 H/5, 21 H/12 and 21 G/8). S.M. Barr and C.E. White. (1991). Scale: 1:50 000. See Geological Survey of Canada Open File 2353. (Contribution to the Canada–New Brunswick Cooperation Agreement on Mineral Development 1990–1995).

Plate 91-31

Tin-bearing float discovery, Mount Pleasant area, New Brunswick. (21 G/7). D.G. Rose. (1991). Scale: 1:50 000. (Canada–New Brunswick Mineral Development Agreement 1984–89).

Plate 91-32

Paleotectonic setting of volcanic rocks within the Canadian Appalachians. Compiled by L.R. Fyffe. (1991). Scale: 1:200 000.

Plate 91-33

NTS grid overlay for New Brunswick. Scale: 1:500 000. Available on paper or plastic.

Plate 91-34A to 91-34D (4 plates)

Borehole maps, Canadian Gypsum Co. Ltd., Hillsborough, N.B. (21 H/15W). H.D. Steeves. (1951). Scale 1 inch equals 100 feet.

Plate 91-35

Geology of the Tower Hill area (NTS 21 G/6b), Charlotte County, New Brunswick. L.R. Fyffe (1990). Scale: 1:20 000.

Plate 91-36, 91-36A to 91-36J (10 plates)

Digital compilation of geochemical stream-sediment data, Lake George area (part of NTS 21 G/14), southern New Brunswick: base, sample locations, Cu, Pb, Zn, Mo, Mn, Sb, W, U.

Compiled by J.M. Mazerolle and M.P. Rennick. (1991). Scale: 1:50 000. See Open File Report 92-1. (Canada–New Brunswick Cooperation Agreement on Mineral Development, 1990–1995).

Plates 91-37 to 91-39 (3 plates)

Index to maps of New Brunswick prepared by GSC (Geological Survey of Canada) 1988–1991: till geochemistry, stream and spring geochemistry, geology. (1991). Scale: 1:500 000.

Plates 91-40A to 91-40G (7 plates)

Geology and structure maps. (21 O/8g, 8h; 21 O/9a, 9b; 21 O/9c, 9d; 21 O/9g, 9h; 21 O/10a, 10b; 21 P/5e, 5f; 21 P/12c, 12d). C.R. van Staal. (1991–92). Scale: 1:20 000. (Canada–New Brunswick Cooperation Agreement on Mineral Development,1990–1995).

Plates 91-41 to 91-46 (6 plates)

Coastal geomorphology / géomorphologie littorale; legend/légende. (parts of 11 L/4; 21 H/16; 21 I/1). D. Bérubé. (1990). Scale: 1:10 000.

Plates 91-47 to 91-50 (4 plates)

Tobique project: bedrock geology maps. (21 O/7c, 7d, 7e, 7f). R.A. Wilson. (1991). Scale: 1:20 000. (Canada–New Brunswick Cooperation Agreement on Mineral Development, 1990–1995).

Plate 91-51

Bedrock geology of Mt. Carleton Park, Restigouche and Northumberland counties (parts of 21 O/7b, 7c, 7d, 7e, 7f, 7g). R.A. Wilson (1991). Scale: 1:20 000. (Canada–New Brunswick Cooperation Agreement on Mineral Development, 1990–1995).

Plates 91-52 and 91-53 (2 plates)

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BATHURST REGIONAL OFFICE 1991. Posters presented by J. Langton, S.R. McCutcheon, M. Parkhill, and J. Walker at the 16th annual Review of Activities, Fredericton, New Brunswick.

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FYFFE, L.R. 1991. Tectonic significance of the St. Croix Terrane, southwestern New Brunswick. Paper presented at the Annual Meeting of the Atlantic Geoscience Society in Amherst, Nova Scotia. Abstract published in Atlantic Geology, **27**, p. 152.

FYFFE, L.R. 1991. Paper on results of studies in New Brunswick presented at the 16th annual Review of Activities, Fredericton, New Brunswick.

FYFFE, L.R., LANGTON, J., RUITENBERG, A.A., WALKER, J., and WILSON, R.A. 1991. Poster display presented at the Annual Meeting and Convention of the Prospectors and Developers Association of Canada, Toronto, Ontario. It comprised the following posters: Rollingdam Project (L.Fyffe); Bathurst Camp (J. Langton); Caribou Deposit Project (J. Langton); Annidale Project (A.A. Ruitenberg); Generalized Geology of the Jacquet River Area (J. Walker); Bedrock Geology of the Riley Brook Area (R.A. Wilson); Generalized Geology of the Tobique–Chaleur Belt (R.A. Wilson)

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GEOSCIENTIFIC SERVICES SECTION 1991. Posters presented by G.W. Crouse, L.R. Fyffe, A.G. Pronk, A.A. Seaman, and R.A. Wilson at the 16th annual Review of Activities, Fredericton, New Brunswick.

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IRRINKI, R.R. 1991. Geological Surveys Geoscience Information Systems activities. Paper presented at the Land Information Forum 91, Fredericton, New Brunswick.

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PRONK, A.G. 1991. Applications of Quaternary mapping in New Brunswick. Poster presented at the Biennial Meeting of the Canadian Quaternary Association, CANQUA 1991, Fredericton, New Brunswick. Abstract published in *Atlantic Geology*, **27**, p. 241.

RUITENBERG, A.A. 1991. Geology and tectonic setting of some precious metal deposits in Nevada and Idaho — comparison with New Brunswick. Paper presented at the March 7, 1991 meeting of the New Brunswick Branch of the Canadian Institute of Mining, Metallurgy and Petroleum, Fredericton, New Brunswick. Paper published by Mineral Resources Division (Reference 185, 9 p.)

RUITENBERG, A.A. 1991. Paper on exploration and projects in southern New Brunswick presented at the 16th annual Review of Activities, Fredericton, New Brunswick.

RUITENBERG, A.A., and MCLEOD, M.J. 1991. Metallogenic implications of a newly discovered Ordovician island arc sequence in southern New Brunswick. Paper presented by A.A. Ruitenberg at a special session on "Mineralization in the Grenville Province and the Appalachians," held in conjunction with the Annual Meeting of the Geological Association of Canada, Toronto, Ontario. Abstract published in the Program with Abstracts, Geological Association of Canada Annual Meeting, A-1081.

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SUSSEX REGIONAL OFFICE 1991. Posters presented by A. Caron, S. Johnson, M. Mazerolle, M. McLeod, and A.A. Ruitenberg at the 16th annual Review of Activities, Fredericton, New Brunswick.

WALKER, J.A., GOWER, S., and LEBLANC, S. 1991. Siluro-Devonian tectonostratigraphic relationships, western margin of Elmtree Inlier, northern New Brunswick. Poster presented at the Annual Meeting of the Atlantic Geoscience Society, Amherst, Nova Scotia. Abstract published in *Atlantic Geology*, **27**, p. 164.

WEBB, T.C. 1991. A "new dimension" to mineral exploration and development in New Brunswick. Paper presented at the 16th annual Review of Activities, Fredericton, New Brunswick.

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CHAPTER 2.
MINERAL EXPLORATION IN NEW BRUNSWICK

METALLIC MINERALS

SUMMARY OF EXPLORATION ACTIVITY Exploration expenditures in northern New Brunswick during 1991 were approximately $9 500 000 according to the results of an unofficial telephone poll taken at the end of October. The 1990 total, $11 000 000, was determined by the same method. In total, Noranda Exploration Company, Limited and Brunswick Mining and Smelting Corporation Limited spent about $6 000 000, down $1 500 000 from 1990. However, during the year a few companies became new players in northern New Brunswick exploration. The number of claims recorded had increased slightly, from 3750 in 1990 to 3910 in 1991. With one exception, the focus of exploration was on base metals.

Noranda Exploration Company, Limited concentrated its efforts (more than half of its $4 700 000 expenditure) in the Heath Steele–Stratmat–Halfmile Lake area (Figure 14). Two new discoveries were made at Heath Steele, one was the HC-4 zone (west of the C zone) and the other was in the C-North zones. Follow-up drilling is in progress. Delineation of the Stratmat S-1 deposit has been completed and an economic evaluation is underway. The remaining expenditures were about equally divided among properties within and outside the Bathurst camp. A 3.35 m intersection grading 0.75% Pb, 6.18% Zn, and 0.16% Cu was made within a sedimentary horizon on the east limb of the Strachens Lake deposit. Outside the Bathurst camp, there were three main target areas: Shingle Gulch, McKenzie Gulch, and Patapedia. Grid work and trenching were conducted on all three properties and drilling of selected targets is planned. However, the discovery of a new copper showing by Raoul Lagacy prompted Noranda to stake an additional 150 claims in the McKenzie Gulch area, where an intensive exploration/drilling programme was underway by the end of 1991.

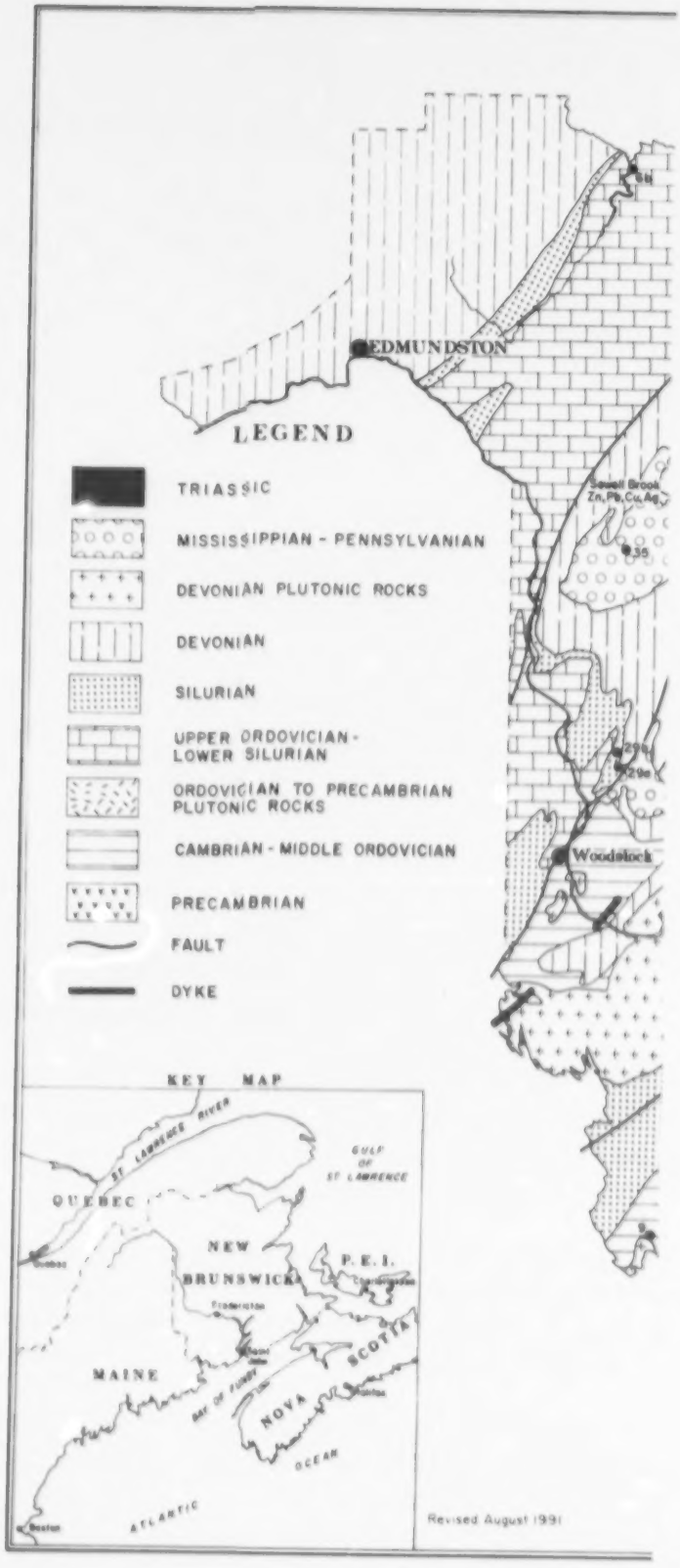
Brunswick Mining and Smelting Corporation Limited (Figure 14) spent approximately $1 400 000 on its properties during 1991. More than half of this amount was for drilling on the company's Northend zone near the No. 12 mine. Since 1989, eighteen holes have been completed; two are currently in progress. These two holes are critical because they are testing the only area where the mineralized zone remains open. Previously, drilling showed that the zone dies out (or more likely is cut out by a thrust fault) to the north.

Much of the remaining exploration effort was in the vicinity of the mined-out No. 6 deposit. A deep-electromagnetic (deep-EM) survey was completed over the area but "cultural noise" from water lines, power lines, etc. caused interpretation difficulties. In the fall, three deep holes were drilled at Austin Brook to test the sulphide zone associated with the iron formation.

Teck Corporation (Figure 14) opened an office in Bathurst in June, shortly after acquiring about 650 claims in the Bathurst camp. Stratabound Minerals Corp. has entered into an

Legend for Figure 14:

1. Aurtec Incorporated
2. BHP-Utah Mines Ltd.
3. Black, Don
4. BP Resources Canada Ltd.
5. Brooks, Earnest
6. Brunswick Mining and Smelting Corporation Limited
7. Burns, James
8. Carroll, Wayne
9. Cobrun Mining Corporation
10. Connor, Robert
11. Costigan Gold Corporation
12. East West Caribou Mining Limited
13. Falconbridge Limited
14. Goldfluor Exploration Limited
15. Gordon, Morton
16. Graham, Donald
17. Graham, Ian
18. Granges Inc.
19. Hachey, Barry
20. Hachey, Wilfred
21. Heath Steele Mines Limited
22. Hickey, Owen
23. International Corona Corporation
24. Jamieson, Thomas A.
25. Kelly, James
26. Key Anacon Mines Limited
27. Kierans, M.D.
28. LAC Minerals Limited
29. Lacana Mining Corporation Limited
30. Lockhart, A.Wayne
31. Major General Resources Limited
32. Maritime Resource Research Limited
33. Mattagami Lake Exploration Limited
34. McHale, Barry
35. Merrithew, Dan
36. Mispec Resources Inc.
37. NEBEX Resources Ltd.
38. Noranda Exploration Company, Limited
39. Northeast Exploration Services Limited
40. NovaGold Resources Inc.
41. O'Connell, Orville
42. O'Neil, David
43. PGE Resource Corp.
44. Pitre, Norman
45. Placer Dome Incorporated
46. Rio Algom Exploration Inc.
47. Ross, Frank E.
48. Seabright Exploration Inc.
49. Sevo, le Exploration Inc.
50. Smith, Michael
51. Stairs, Robert
52. Stewart, Beverly
53. Stratabound Minerals Corp.
54. Teck Corporation
55. Teck Exploration Limited
56. Whaley, K.D.A.
57. Willett, Claude



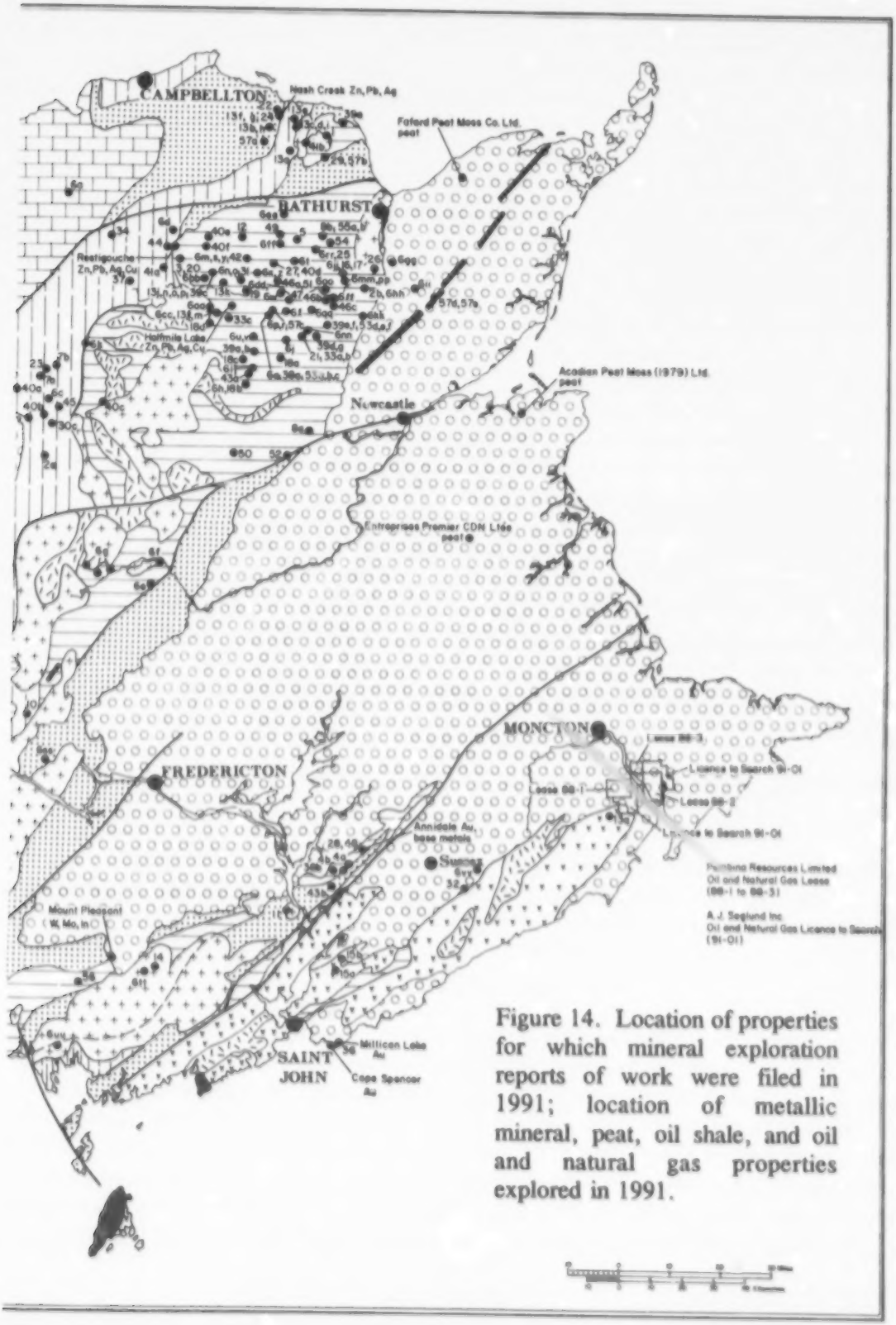


Figure 14. Location of properties for which mineral exploration reports of work were filed in 1991; location of metallic mineral, peat, oil shale, and oil and natural gas properties explored in 1991.

exploration/joint venture agreement with Teck Corporation that will include the following Stratabound properties in New Brunswick: the Captain North Extension (CNE) property (except the CNE open pit), Taylor Brook, Stratmat West, and Stratmat North. Preliminary exploration has been completed on most of the claims. Trenching was completed on the claim group north of the No. 12 mine and a number of holes were drilled in the vicinity of the CNE deposit.

NovaGold Resources Inc. (Figure 14) follows Noranda, Brunswick, and Teck in total exploration expenditures for northern New Brunswick. Early in the year, four holes were drilled near Sears Lake to test induced polarization (IP) anomalies in an area where geochemical samples yielded highly anomalous lead–zinc. A 25-hole definition drilling programme on the Sewell Brook discovery was completed by March, showing that the deposit is a classic Kuroko-type; one zone contains approximately 25 000 t grading 20% combined lead-zinc. In the spring, an airborne survey was flown over the 129-claim Sears Lake group. In May, a joint venture agreement that included both the Sears Lake and Sewell Brook properties was made with Kennecott Canada Inc.; NovaGold continued as the operator. Subsequently, 320 line-kilometres of grid was established over the 182-claim Sewell Brook group to permit detailed mapping, prospecting, and geophysical surveys of the ground outside the discovery zone. Drill targets were tested in November of 1991. Another 33 claims were added to the Sears Lake block.

NovaGold also investigated its 33-claim California South property, part of a 124-claim block east of California Lake. An IP survey was conducted and the resulting anomalies were trenched in early fall. Samples of a copper-bearing chloritic and siliceous sedimentary unit discovered in one trench yielded up to 5.5% copper. Subsequently, five shallow holes were drilled; one intersected a 3 m section grading 2.93% Cu and another cut a 1.2 m section grading 2.46% Cu. A follow-up gravity survey was conducted over the mineralized area in December; further drilling is planned.

In addition, NovaGold completed a feasibility study on its Murray Brook copper zone in 1991.

Falconbridge Limited (Figure 14) completed 1500 m of drilling on its Nash Creek property in the late spring of 1991. However, most of the company's exploration effort was focused on its West Bathurst property in the Halfmile Lake–Devils Elbow–TV Tower area. Early in the fall, a 2750 m drilling programme was completed in the northern part of this property. No results have been released.

BHP-Utah Mines Ltd. is another new player in northern New Brunswick mineral exploration. The company is operating independent exploration programmes from its Canadian and American offices. The Toronto office conducted preliminary exploration on its 186-claim Gordon Meadow Brook property, between Key Anacon and Brunswick No. 6. This culminated in a trenching programme in the late fall. The Bangor office managed the company's 369-claim block near Plaster Rock and carried out reconnaissance in the southern part of the Bathurst camp. Another 280 claims were added to the Gordon Meadow Brook property during the summer and another 100-claim block was staked near Guagus Lake in the southern part of the camp.

Rio Algom Exploration Inc. (Figure 14) drilled five holes on its 273-claim Nepisiguit Brook property. Three holes were drilled in the latter part of 1990. One hole containing iron formation was deepened and two additional holes were drilled early in 1991 to test gravity targets. In February, a 162-claim Nepisiguit South group was staked south of the Captain deposit and a 118-claim Taylor Brook group was staked along Nepisiguit River. During the summer, exploration was focused on claims in the vicinity of the Wedge deposit in order to identify drilling targets.

Phelps Dodge Corporation of Canada Ltd., another newcomer in 1991, optioned the 64-claim Turgeon property belonging to Heron Mines Limited. A 700 m drilling programme began in late October to test a previously identified but little-explored zinc zone. Previous work on the property had outlined a Cyprus-type massive sulphide deposit containing 1 to 2 000 000 t of ore grading approximately 4% Zn and 1.5% Cu. In November, about 400 additional claims were staked around the Turgeon property.

Stratabound Minerals Corp. (Figure 14) carried out development work on its Captain North Extension (CNE) deposit and general exploration on some of its other claim groups prior to signing a letter of agreement with Teck Corporation. In September of 1991, another 15 000 t of ore was mined and shipped to Heath Steele for milling. Notably, the company found new reserves to equal the amount that had been mined. The average grade of the ore mined was about 12% Zn, 5% Pb, and 170 g/t Ag. An additional 13 500 t of ore, mined before the year's end, had not been milled.

Freewest Resources Inc. worked on two properties, a 144-claim block in the Plaster Rock area and an 18-claim block near Fogans Lake, in the west-central part of the Bathurst camp. One trench was dug at Fogans Lake in an unsuccessful attempt to find the bedrock source of base-metal-bearing boulders. Further work is planned for 1992.

NEBEX Resources Ltd. (Figure 14) found base-metal-bearing rhyolite boulders associated with a linear magnetic anomaly on its 100-claim Moose Brook group. Grab samples yielded up to 2.37% Pb and 1.15% Zn.

Cominco Ltd. drilled one hole on its 27-claim Nepisiguit–Mosher group. No results have been released.

Sharpe Energy and Resources Limited staked claims in three areas of the Bathurst camp: northwest of Key Anacon, near the mouth of Moody Brook, and near Indian Falls. The company acquired a total of 61 claims.

PGE Resource Corp. (Figure 14) conducted a deep-EM survey over part of its 98-claim Bills Lake group.

Granges Inc. (Figure 14), the only company not looking for base metals, drilled one hole on its Middle River gold property. The company tested the northeasterly extension of a very low frequency (VLF) anomaly associated with known gold-bearing rocks. A wide cross-cutting

alteration zone was encountered within a siltstone–wacke sequence. Two core intercepts from the alteration zone, 4.2 m and 2.8 m long, graded 9.4 g/t and 10.1 g/t Au, respectively. More work is planned.

Other companies that held claims in northern New Brunswick but did little or no work in 1991 include: Placer Dome Inc., Corona Corporation, Acadia Mineral Ventures Limited (Guinness Gold Resources Limited), Seabright Exploration Inc. (Corner Bay Minerals Inc.), East West Caribou Mining Limited, Key Anacon Mines Limited, Major General Resources Limited, Sevogle Exploration Inc., Marshall Minerals Corp., LAC Minerals Limited, Shamrock Resources Inc., Aurtec Mining Development Inc., Golden Bay Resources, Northeast Exploration Services Limited, and North American Rare Metals Ltd.

Base-metal exploration in southern New Brunswick was revived and gold exploration remained active during 1991. There was renewed interest in tin–base-metal deposits and associated rare elements, including indium and bismuth. Exploration for industrial minerals such as aggregate and limestone also was reactivated.

Brunswick Mining and Smelting Corporation Limited and Noranda Exploration Company, Limited (Figure 14) conducted base-metal exploration programmes (including geochemical and geophysical surveys, trenching, and diamond-drilling) in several areas of southern New Brunswick. These include: (1) the Little McDougall Lake and Henderson Settlement areas in the Annidale–Beulah Zone, which has potential for Kuroko- and SEDEX-type base-metal-sulphide deposits similar to those found in the Penobscot Bay area of southeastern Maine, and (2) the Peekaboo Corner, Cedar Camp, Albert Mines, and Hopewell Cape areas in southeastern New Brunswick, which have potential for Mississippi-Valley- or Gays-River-type base-metal-sulphide deposits. Of particular interest was a 2.1 m intersection assaying 1.77% Cu in a bore hole drilled by Noranda Exploration Company, Limited into the Devil Pike claim group, immediately west of Scotch Settlement in the Queen Brook Formation. This is significant because the Queen Brook Formation is considered to be the stratigraphic equivalent of the Ellsworth Formation in Maine, which hosts the Black Hawk massive sulphide deposit.

During the fall of 1991, BHP-Utah Mines Ltd. (Figure 14) staked a large claim group in the southwestern Miramichi Zone, south of Benton. This area has potential for volcanogenic massive sulphide deposits. Robert Connor, a local prospector, explored a prospect in the Howland Ridge area of the southwestern Miramichi Zone. Well-defined base-metal sulphide anomalies that coincide with electromagnetic anomalies were delineated.

Corner Bay Minerals Inc. conducted an IP survey and a diamond-drilling programme on a prospect in the Annidale–Beulah Zone. The prospect is underlain by an Ordovician volcanic and sedimentary sequence, which has potential for Kuroko-type base-metal-sulphide deposits similar to those in the Penobscot Bay area of southeastern Maine.

Gold exploration continued in the Caledonia Zone along the Bay of Fundy, the Annidale–Beulah and St.Croix zones north and northeast of the Saint George Batholith, and in the contact

aureole of the Pokiok Batholith.

Acadia Mineral Ventures Limited drilled thirteen holes to test new exploration targets delineated by geochemical and geophysical surveys in the Mispec Resources Inc. property at Cape Spencer, southeast of Saint John. One hole drilled into the Mitchell's Bog zone assayed 5.84 g/t Au over 1 m. Another hole in this zone intersected two adjacent mineralized sections that assayed 4.60 g/t and 2.83 g/t Au over 1.0 and 0.7 m, respectively.

Corner Bay Minerals Inc. drilled the down-dip extension of a gold-bearing shear zone in the Annidale area. Previous drilling in this shear zone intersected 1.37 g/t Au and 3.12 g/t Au over 1.5 m and 1.6 m, respectively.

Goldfluor Exploration Limited (Figure 14) drilled six short holes to trace a gold-bearing shear zone in the Tower Hill area of the St. Croix Zone, northeast of St. Stephen. Previously collected grab samples from this prospect assayed up to 80.9 g/t Au. The company also conducted more sampling to trace a gold-bearing zone at Jimmy Hill, north of the Saint George Batholith.

Gradually improving tin prices and a rapid increase in demand for indium and bismuth have revived interest in the Mount Pleasant deposit (Figure 14) and in tin prospects to the west of the deposit. Mount Pleasant has published reserves of 5 000 000 t assaying 0.79% Sn, but the discovery of the high-grade Saddle zone will undoubtedly increase the tin reserves. It has also been estimated that Mount Pleasant contains about 25% of the world's known reserves of indium. The discovery of high-grade tin float (two samples assaying 20.3% and 21.0% Sn) at True Hill, 4 km west of Mount Pleasant, initiated new staking in that area. In the Pleasant Ridge area, 1 km west of True Hill, K.D.A. Whaley sampled three trenches across a tin–zinc-bearing vein system that intersected: (1) 0.7 m assaying 15.5% Zn and 0.98% Sn; 1.8 m assaying 9.02% Zn and 0.98% Sn, and 2.0 m assaying 1.5% Zn and 1.35% Sn; (2) 2.7 m assaying 6.25% Zn and 1.04% Sn; (3) 1.5 m assaying 9.21% Zn and 0.59% Sn, and 1.1 m assaying 8.21% Zn and 0.78% Sn. At the time of writing this report, no indium assays were available for this prospect.

Dickenson Mines Ltd. drilled properties at Samphill and Hicksville for high-calcium lime. Additional limestone reserves will assure the future for the important lime products industry in the Havelock area.

L.E. Shaw Ltd. explored its Bayside claims north of St. Andrews for aggregate reserves. The claim group covers a large high-quality aggregate resource close to a deep-water port.

Editor's Note: The first name (company or individual) given for each assessment report is that of the holder of the mining rights. Since the author of the report may not be the holder of the rights, please consult the GEOSCAN index for cross-reference information. The GEOSCAN reference number follows the claim group name. Reports are arranged in the following order: (1) by zone, (2) alphabetically by company or individual, (3) by NTS sheet, and (4) alphabetically by property name.

MATAPEDIA–AROOSTOOK ZONE

6. Brunswick Mining and Smelting Corporation Limited

(a) BURNTLAND LAKE Claim Gp. (473981) 21 O/10W

Confidential until January 16, 1993. This 58-claim group is located 27 km east of the village of Kedgwick. Work included establishment of a grid and soil and rock sampling.

(b) PATAPEDIA Claim Gp. (474123) 21 O/14W

Confidential until December 17, 1993. The 333-claim Patapedia group is located approximately 25 km north-northwest of the village of Kedgwick. Work consisted of linecutting (83 km) and magnetometer and VLF EM surveys. A total of 2693 B-horizon soil, 88 silt, and 68 heavy-mineral-concentrate samples were collected and analyzed for up to 31 elements.

29. A.Wayne Lockhart

(a) HARTLAND LIMESTONE Claim Gp. (474043) 21 J/6W

This group of 6 claims, 13 km northeast of Hartland, covers a limestone prospect in the Ordovician–Silurian Matapédia Group. A grid was established on the property to provide location control for future geologic mapping and sampling. Several previously unknown limestone outcrops were discovered in the central portion of the property, enhancing the limestone potential of this area.

(b) HARTLAND LIMESTONE Claim Gp. (474042) 21 J/6W

This 2-claim group, 14 km northeast of Hartland, covers an area underlain by high-calcium limestone of Carboniferous age. A grid was established on the property to provide survey control for geologic mapping and sampling.

TOBIQUE-CHALEUR ZONE

2. BHP-Utah Mines Ltd.

(a) HARRISON RIDGE Claim Gp. (474131) 21 J/14E

Confidential until December 30, 1993. This group of 371 claims is located approximately 25 km east of Plaster Rock. A total of 3782 samples (B-horizon soil, seep, and stream sediment) were collected and analyzed for 16 elements using DCP analyses.

6. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(c) SHINGLE GULCH Claim Gp. (474094) 21 O/3E

Confidential until November 6, 1993. This property consists of 4 claim groups comprising a total of 476 contiguous claims. It is located approximately 35 km northeast of Plaster Rock. Work consisted of linecutting (42.3 km), general prospecting, a geographic information systems (GIS) compilation of available data, trenching (12 trenches totalling 624 m), 4 pits, BEEPMAT prospecting, and airborne HEM, VLF EM, and magnetometer surveys (526 line-kilometres). A total of 102 rock samples were analyzed for up to 7 elements and of the 1278 B-horizon soil samples collected, 465 were analyzed for Cu, Pb, Zn, Ag, Au, As, and Sb.

(d) MCCORMACK RAMSAY Claim Gp. (474105) 21 O/10E

Confidential until November 25, 1993. The 25-claim McCormack Ramsay group is located approximately 90 km west of Bathurst. Work consisted of backfilling trenches and tree planting.

7. JAMES BURNS

(a) MABEL BROOK Claim Gp. (474082) 21 O/3E

This group of 4 claims is located approximately 9.5 km east-southeast of the community of Riley Brook. A total of 103 soil samples were collected and analyzed to test an arsenic anomaly as well as the base-metal potential of the claim group. Isolated anomalous values up to 20 ppm Cu, 115 ppm Pb, and 325 ppm Zn correlate with an IP–resistivity contact (shale/rhyolite geological contact) and a previously defined arsenic anomaly. Geophysical surveys were recommended to define areas possibly related to gold and/or sulphide mineralization.

(b) RILEY BROOK Claim Gp. (474083) 21 O/3E

This 6-claim property is located 12.5 km due east of the community of Riley Brook. The claims were originally staked for their gold potential following the release of lithogeochemical data by the Province. A recent base-metal discovery prompted establishment of a grid (3.2 km) and a soil geochemical survey to test the claims for base-metal potential. Geochemical analysis of 125 soil samples yielded generally low results: up to 18 ppm Cu, 88 ppm Pb, and 127 ppm Zn. The report recommended that the soil samples be tested as a means to follow up the anomalous Au lithogeochemical values from the 1990 survey.

13. FALCONBRIDGE LIMITED

(a) JACQUET RIVER Claim Gp. (474003) 21 O/16E

Confidential until February 28, 1993. The 1274-claim Jacquet River group is located approximately 38 km northwest of Bathurst. Work included 1:10 000 scale geologic mapping and lithogeochemical sampling.

(b) JACQUET RIVER Claim Gp. (474016) 21 O/16E

Confidential until April 2, 1993. This group of 153 claims is located 1 km south of Lorne and approximately 50 km northwest of Bathurst. The work reported includes linecutting, IP pole-dipole magnetometer, and VLF surveys.

(c) MCCOMBE OPTION Claim Gp. (473992) 21 O/16E

Confidential until February 4, 1993. This 85-claim parcel, made up of 6 claim groups, is located 7 km south-southwest of the village of Jacquet River. Work reported includes prospecting, pole-dipole and gradient IP surveys, and a lithogeochemical survey.

(d) MCCOMBE '91 Claim Gp. (474039) 21 O/16E

Confidential until May 28, 1993. This group of 85 claims is located approximately 40 km northwest of Bathurst. Three diamond-drill holes were reported.

(e) NASH CREEK EXTENSION Claim Gp. (474007) 21 O/16E

Confidential until March 7, 1993. The 223-claim Nash Creek Extension group is located 38 km northwest of Bathurst. Work consisted of diamond-drilling.

(f) NASH CREEK-90 Claim Gp. (473986) 21 O/16E

Confidential until January 25, 1993. This 225-claim group is located 48 km northwest of the city of Bathurst. Work included linecutting and lithogeochemical, diamond-drilling, and IP surveys.

(g) NASH CREEK-90 Claim Gp. (474084) 21 O/16E

Confidential until October 8, 1993. This group of 225 claims is located 48 km northwest of Bathurst, near the communities of Lorne and Doyleville. Three diamond-drill holes were completed.

(h) RAMSAY NASH CREEK Claim Gp. (474081) 21 O/16E

Confidential until September 27, 1993. The Ramsay Nash Creek group (388 claims) is located approximately 50 km northwest of Bathurst. Work consisted of 6 diamond-drill holes.

(i) MITCHELL SETTLEMENT Claim Gp. (474019) 21 P/13W

Confidential until April 5, 1993. This report covers work carried out on 45 claims registered under 11 claim groups. The claims are located 38 km northwest of Bathurst. Work on the property consisted of 1:2000 scale mapping, prospecting, a diamond-drilling programme, and a lithogeochemical survey.

22. OWEN HICKEY

NASH CREEK Claim Gp. (474053) 21 O/16E

Confidential until July 16, 1993. This group of 12 claims is located 3 km southeast of Nash Creek. Work on the property included soil sampling and prospecting.

23. INTERNATIONAL CORONA CORPORATION

BLACK MOUNTAINS Claim Gp. (474132) 21 O/3E

Confidential until December 30, 1993. The Black Mountains group comprises 163 claims. It is located approximately 11 km east of the community of Riley Brook. Work consisted of a compilation of available data and airborne magnetic (total field and vertical gradient), apparent resistivity, and VLF EM total-field geophysical surveys (557 line-kilometres).

24. THOMAS A. JAMIESON

TAJ-2 Claim Gp. (474065) 21 O/16E

This group of 10 claims is located in the Lorne Settlement area, 50 km northwest of Bathurst. Work consisted of assaying 3 soil and 2 rock samples for Cu, Pb, Zn, Ag, and As. None of the samples assayed showed particularly high values for any of these elements.

30. A.WAYNE LOCKHART

(c) PLASTER ROCK Claim Gp. (474104) 21 O/3E

Confidential until November 25, 1993. The 131-claim Plaster Rock group encompasses 3 claim blocks that are located approximately 28 km northeast of Plaster Rock. An airborne VLF EM geophysical survey (282 line-kilometres) was completed.

34. BARRY MCHALE

NINE MILE BROOK Claim Gp. (474046) 21 O/10W

This group of 150 claims is located approximately 35 km east of St. Quentin. Work on the property included the collection and assaying of 3943 soil and 30 stream-sediment samples for Au. This survey resulted in the discovery of minor Au anomalies. To follow up the soil anomalies, 128 pits were dug but no correlation could be made between soil anomalies and bedrock.

35. DAN MERRITHEW

AIRFIELD Claim Gp. (474146) 21 J/14W

This 4-claim group is located in the village of Plaster Rock. The property is underlain by Carboniferous strata, an outlier within the Tobique–Chaleur Zone. The claims were staked to test the quality of gypsum in the bedrock. Assays yielded up to 88% gypsum. Other work included grid establishment, road building, trenching (1 trench totalling 167 m), general prospecting, and geological mapping. Further exploration in the surrounding area is planned.

37. NEBEX RESOURCES LTD.

MOOSE BROOK Claim Gp. (474134) 21 O/7E

The 100-claim Moose Brook group is located 80 km west of Bathurst. The claims were staked over sedimentary and volcanic rocks of the Devonian Tobique Group following NovaGold's Sewell Brook base-metal discovery in similar rocks near Plaster Rock. Work included general prospecting to locate and sample previously reported mineralized float. No outcrop was found so boulder mapping was utilized. Minor amounts of sulphide mineralization were observed in cherty, light grey rhyolite. A total of 45 mineralized samples were assayed, yielding values up to 0.56% Cu, 2.37% Pb, 1.15% Zn, and 0.004% Ni. The report recommended that the northern 50 claims of the group be dropped. Further exploration was recommended on an aeromagnetic anomaly thought to be the source of the mineralized felsic volcanic boulders; suggested surveys included linecutting, magnetic and electromagnetic surveys, soil geochemical surveys, and possibly diamond-drilling.

40. NOVAGOLD RESOURCES INC.

(a) BLUE MOUNTAIN BROOK Claim Gp. (474061) 21 O/3E

Confidential until July 31, 1993. This 6-claim group is located approximately 10 km southeast of the community of Riley Brook. Work consisted of general prospecting and geochemical analysis of 13 rock samples for Cu, Pb, Zn, Au, and Ag.

(b) SEWELL BROOK Claim Gp. (474026) 21 O/3E

Confidential until April 23, 1993. The Sewell Brook group (182 claims) is located approximately 30 km northeast of Plaster Rock. Work consisted of linecutting (2.5 km), general prospecting, trenching (2 trenches totalling 60 m), geological mapping at a scale of 1:2500, diamond-drilling (45 holes totalling 3989 m), collection of 114 B-horizon soil samples for future analysis, and topographic mapping. Gradient array IP, Max-Min II horizontal-loop EM, surface Pulse-EM (Crone deep-EM), and Crone downhole Pulse-EM geophysical surveys were also completed. Drill core samples were analyzed for Cu, Pb, Zn, Ag, and Au.

41. ORVILLE O'CONNELL

(a) O'CON WEST Claim Gp. (474130) 21 O/7E

This group of 21 claims is situated approximately 70 km west-southwest of Bathurst. Work consisted of linecutting (1.2 km), general prospecting, and collection and logging of 38 rock samples. No recommendations were made.

44. NORMAN PITRE

RAMSAY BROOK Claim Gp. (474071) 21 O/10E

This 4-claim group is located approximately 60 km west of Bathurst and is transected by Highway 180. Work consisted of prospecting and a VLF EM-16 survey that outlined several weak anomalies parallel to the geological trend.

45. PLACER DOME INCORPORATED

SHINGLE GULCH Claim Gp. (474005) 21 O/3E

The Shingle Gulch group of 68 claims is located 15 km northeast of Plaster Rock. The claims were staked on the basis of anomalous lithogeochemical gold and base-metal values released by the Department of Natural Resources and Energy. Work consisted of a compilation of previous work performed in the area and a soil geochemical survey. A total of 639 B-horizon soils were collected and analyzed, yielding several highly anomalous values: up to 221 ppm Cu, 9960 ppm Pb, 3930 ppm Zn, and 14.68 ppm Ag. Further work was recommended, including detailed mapping, soil and rock geochemical surveys, trenching, and drilling.

57. CLAUDE WILLETT

(a) FALLS GULCH Claim Gp. (473982) 21 O/16E

Confidential until January 18, 1993. This 20-claim group is located 15 km south-southwest of Jacquet River. Work on the property consisted of a Max-Min survey.

ELMTREE ZONE

1. AURTEC INCORPORATED

WALKER BROOK Claim Gp. (474136) 21 P/13W

Confidential until January 2, 1994. The Walker Brook group (12 claims) is located 17 km northwest of Bathurst. Work consisted of a compilation of geochemical and geophysical data.

29. LACANA MINING CORPORATION LIMITED

ALCIDA SOUTH Claim Gp. (474006) 21 P/13W

This group of 24 claims is located approximately 20 km north-northwest of Bathurst. A listing of previous work is reported. Work carried out on the property included establishment of

a grid (54.5 km) as well as magnetometer and VLF surveys (49.8 km). Four VLF anomalies were outlined; anomalies A and B are coincident with geochemical anomalies, anomalies C and D have no such association. The magnetometer survey shows a gradual regional increase to the north. A total of 1276 soil samples were collected and analyzed for Au, As, Pb, Zn, and Ag; several anomalies were outlined. One hundred overburden Pionjar holes were drilled on the property; these outlined one good target.

39. NORTHEAST EXPLORATION SERVICES LIMITED

(a) GUITARD BROOK Claim Gp. (474010) 21 P/13W

This 6-claim group is located 25 km northwest of Bathurst. Work consisted of linecutting (3.2 km) accompanied by VLF and total-field magnetic surveys (2.6 km). Weak anomalies were outlined. It was suggested that one strong east-west-trending anomaly corresponds to a contact between mafic rocks to the south and felsic or sedimentary rocks to the north.

41. ORVILLE O'CONNELL

(b) NORCONN Claim Gp. (474106) 21 P/13W

The Norconn group of 10 claims straddles the Belledune River south of Highway 11, approximately 40 km northwest of Bathurst. Work consisted of collection of 39 rock samples for analysis. Analysis will be performed when funds become available.

57. CLAUDE WILLETT

(b) ALCIDA NORTH Claim Gp. (474017) 21 P/13W

This 6-claim group is located 21 km north-northwest of Bathurst. Work consisted of restaking the original claim block.

MIRAMICHI ZONE

2. BHP-UTAH MINES LIMITED

(b) GORDON MEADOW Claim Gp. (474133) 21 P/5E

Confidential until December 30, 1993. The Gordon Meadow block (100 claims) lies 25 km south of Bathurst. Work involved a 520 line-kilometre airborne geophysical survey (VLF EM, magnetometer, Max-Min, hand-held magnetometer susceptibility), soil and stream geochemical

surveys, wacker drilling, excavation of pits and trenches, whole rock analyses, and geological mapping. Interpretation of the data is ongoing.

3. DON BLACK

UPSALQUITCH Claim Gp. (474116) 21 O/7E

The Upsalquitch group (13 claims) is located 90 km west of Bathurst. Work consisted of general prospecting, cleaning of an old 3-m-long trench, and collecting 19 rock and 35 soil samples. A total of 22 soil samples were analyzed, yielding values up to 151 ppm Cu, 79 ppm Pb, 128 ppm Zn, 90 ppb Au, and 42 ppm As.

5. EARNEST BROOKS

MIDDLE RIVER Claim Gp. (474075) 21 O/9E

This 6-claim group is located approximately 50 km west-southwest of the City of Bathurst. Work consisted of relogging core from three holes drilled by Umex and a reinterpretation of the geology.

6. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(e) MCBEAN BROOK Claim Gp. (474032) 21 J/10E

Confidential until May 10, 1993. This group of 106 claims is located approximately 15 km northeast of Boiestown. Work consisted of grid establishment (62.2 km), general prospecting, and collection and analysis of 1058 B-horizon soil samples for Cu, Pb, Zn, As, Ag, Sb, Mo, and Au. Eleven rock samples were collected and analyzed for seven elements.

(f) TROUT BROOK Claim Gp. (474033) 21 J/10E

Confidential until May 10, 1993. This 30-claim group is located approximately 20 km northeast of Boiestown. Work included the establishment of 11.35 km of grid, general prospecting, and the collection and geochemical analysis of 208 B-horizon soil samples for Cu, Pb, Zn, As, Ag, Sb, Mo, and Au. Fifteen rock samples were analyzed for seven elements.

(g) BURNTHILL Claim Gp. (474048) 21 J/10W

Confidential until June 27, 1993. The 150-claim Burnthill block is located approximately 25 km northwest of Boiestown. It consists of three claim groups (Burnthill Mine, Burnthill North and Burnthill South). One hundred and ninety-four sites were sampled. Till samples were analyzed for Cu, Pb, Zn, As, Ag, Sb, and Au; heavy-mineral concentrates were analyzed for Au.

(h) CHESTER PERIMETER Claim Gp. (474074) 21 O/1E

Confidential until September 5, 1993. This 15-claim group is 110 km from Bathurst, 63 km from Newcastle, and 56 km from the Heath Steele mine site. Previous work on the Chester

deposit was done by Kennco, Newmont Mining, Sullico Mines, and Chester Mines from the late 1950s to the early 1970s. The current project involved a compilation of previous work and geological mapping.

(i) NORTH SEVOGLE Claim Gp. (474058) 21 O/1E

Confidential until July 25, 1993. The North Sevogle group of 19 claims is located 1.3 km northeast of Clearwater Lake and 3 km west of Sevogle Airstrip. Previous work was performed by American Metal Co. (1956), Findathoran Syndicate (1971), Umex (1974), Noranda Exploration Co., Ltd. (1980–86 and 1989–90). The work described in this report included stream-silt sample collection and analysis, and geological mapping/prospecting.

(j) SATELLITE Claim Gp. (474047) 21 O/1E

Confidential until June 25, 1993. This property (159 claims) is 7 km west-southwest of the Heath Steele mine site. The report details previous work as well as the 1990 exploration programme. Work included a soil survey, a Pionjar survey, and various geophysical investigations (magnetometer, VLF electromagnetic, and HLEM). A two-hole diamond-drilling programme was also undertaken.

(k) SERPENTINE RIVER Claim Gp. (474114) 21 O/2W

Confidential until December 4, 1993. This 48-claim group is located 75 km northeast of Plaster Rock. Work consisted of grid establishment (5.6 km), general prospecting, data compilation, and a VLF EM-16 geophysical survey. A total of 167 B-horizon soil and 4 rock samples were collected and analyzed for Cu, Pb, Zn, Ag, and Au. The soils were also analyzed for As and Sb content.

(l) HEATH EAST Claim Gp. (474031) 21 O/8E

Confidential until May 2, 1993. This property consists of 170 claims adjoining the east boundary of the Heath Steele mining lease; the Stratmat and McCormack East properties are to the north. The report outlines work performed in 1989 and 1990. Work on the property consisted of reconnaissance mapping/prospecting, geophysical surveys (VLF, magnetometer, and HLEM), trenching (4 trenches totalling 902 m), and diamond-drilling (2 holes totalling 454.15 m). Most recent work included linecutting (88.64 km), general prospecting, both VLF and magnetometer surveys, and NQ-core drilling (1 hole totalling 913.79 m).

(m) INDIAN LAKE (124) Claim Gp. (474111) 21 O/8E

Confidential until December 2, 1993. The Indian Lake property consists of 16 contiguous claims that are situated approximately 45 km southwest of Bathurst. Results of recent drilling have shown that the property is underlain by metarhyolites. Previous work included grid establishment, magnetometer, electromagnetic, gravity, soil sampling, and diamond-drilling (2 holes). Most recent exploration efforts included additional diamond-drilling (3 holes) in which samples were analyzed for traces of Cu, Pb, and Zn.

(n) LONG POND AND LONG POND SOUTH EXTENSION Claim Gp. (474066) 21 O/8E

Confidential until August 15, 1993. This property consists of 35 contiguous claims that lie approximately 23 km northwest of the Heath Steele mine and mill complex. Exploration consisted of linecutting (12.8 km) and a reconnaissance B-horizon soil survey in which 540 soil samples were collected and analyzed for Cu, Pb, Zn, As, Ag, Au, and Sb.

(o) LONG POND Claim Gp. (474093) 21 O/8E

Confidential until November 4, 1993. The Long Pond property, consisting of 35 contiguous claims, is located approximately 23 km northwest of the Heath Steele mine. Exploration included flagging a 3.87 km grid, a VLF EM-16 survey, and trenching (3 trenches totalling 188.2 m). Forty-three rock samples were collected and analyzed for Au, Ag, As, and Sb content.

(p) MCCORMACK EAST Claim Gp. (474079) 21 O/8E

Confidential until September 25, 1993. This group consists of 65 claims that lie immediately west of Tomogonops Lake. Work included linecutting (55.94 km), a B-horizon soil geochemical survey, geological mapping and prospecting, a Pionjar drilling programme, geophysical surveys (VLF EM and magnetometer), trenching (7 trenches totalling 397.2 m), and a diamond-drilling programme (2 holes totalling 287.73 m). Of 200 rock, 1874 B-horizon soil, and 226 Pionjar samples collected, 169 were analyzed for Cu, Pb, Zn, As, Ag, Sb, and Au.

(q) MCCORMACK WEST Claim Gp. (474045) 21 O/8E

Confidential until June 17, 1993. The McCormack West property consists of 24 claims that are located approximately 6 km northwest of the Heath Steele mine and mill complex. Work involved geological mapping, general prospecting, and a Pionjar drilling programme where samples were collected and analyzed for Cu, Pb, Zn, As, Ag, Sb, and Au content.

(r) MOON LAKE Claim Gp. (474128) 21 O/8E

Confidential until December 17, 1993. This property (77 claims) is located approximately 8 km north-northwest of the Heath Steele mine and mill complex. Work consisted of reconnaissance geological mapping, prospecting, and Pionjar overburden drilling. Linecutting (8 km), a B-horizon soil survey, a Max-Min survey, and trenching (88 m) were also part of the exploration programme.

(s) O'HEARN [SIC] BROOK Claim Gp. (474077) 21 O/8E

Confidential until September 13, 1993. This property, consisting of 24 claims, is situated approximately 40 km southwest of Bathurst. Four trenches totalling 198.12 m were excavated. Ten rock samples were collected and analyzed for Au, Ag, Cu, Pb, and Zn.

(t) ORLO-23 (4279) Claim Gp. (474025) 21 O/8E

Confidential until April 19, 1993. This 23-claim group is located 32 km southwest of Bathurst. Work on the property involved linecutting (53 km), general prospecting, geophysical surveys (magnetometer, VLF EM, and HLEM), trenching (355 m), and geochemical analysis (1894 B-horizon soil samples).

(u) OTTER BROOK Claim Gp. (474035) 21 O/8E

Confidential until May 15, 1993. This claim group consists of 53 claims located approximately 55 km southwest of Bathurst. Work included HLEM, magnetometer, and VLF surveys as well as diamond-drilling (1 hole totalling 468.5 m).

(v) OTTER BROOK Claim Gp. (474040) 21 O/8E

Confidential until May 22, 1993. The Otter Brook property consists of 117 claims that are located approximately 55 km southwest of Bathurst. Work included general prospecting, grid establishment (10.5 km), VLF, magnetometer, and HLEM surveys. A total of 3750 soil samples were collected and analyzed for Cu, Pb, Zn, and Ag.

(w) ROGER BROOK Claim Gp. (474127) 21 O/8E

Confidential until December 17, 1993. This property consists of 25 claims located approximately 2.5 km southeast of the Wedge mine. Work included general prospecting, grid establishment (44.17 km), trenching (7 trenches totalling 756.2 m), and geological mapping at a scale of 1:5000. Also part of the exploration programme were an HLEM survey (8.625 line-kilometres), diamond-drilling (2 holes totalling 408.44 m), and a geochemical survey (101 rock and 1176 B-horizon soil samples collected). Forty-six rock and all B-horizon soil samples were analyzed for Cu, Pb, Zn, As, Ag, Sb, and Au.

(x) SOLE LEATHER BROOK Claim Gp. (474011) 21 O/8E

Confidential until March 6, 1993. The Sole Leather Brook property (31 claims) is approximately 18 km northwest of the Heath Steele mine complex. Work included linecutting (27.44 km), trenching (6 trenches totalling 372.5 m), and general prospecting. Magnetometer and VLF EM geophysical surveys were conducted; 736 B-horizon soil samples were collected and a Pionjar sampling programme was undertaken.

(y) STRACHENS LAKE Claim Gp. (474069) 21 O/8E

Confidential until August 22, 1993. This group, consisting of 30 claims, is located approximately 70 km southwest of Bathurst. Work on the property included diamond-drilling (1 hole totalling 412.39 m) from which samples were analyzed for Cu, Zn, and Ag.

(z) WEST WEDGE Claim Gp. (474049) 21 O/8E

Confidential until July 3, 1993. The West Wedge property (82 claims), is approximately 6.5 km west-northwest of the abandoned Wedge mine in Northesk Parish. A drilling programme consisted of 4 diamond-drill holes totalling 619.36 m. In addition, 80 core samples were collected and analyzed for Cu, Pb, Zn, and Ag.

(aa) LITTLE BALD MOUNTAIN Claim Gp. (474092) 21 O/8W

Confidential until November 4, 1993. This 154-claim group is located approximately 77 km southeast of Bathurst and 26 km west of the Heath Steele mine. Work consisted of grid establishment (139.35 km), geological mapping (1:5000 scale), access road construction (7 km), trenching (8 totalling 1060 m), and Max-Min I, VLF, and magnetometer surveys. A total of 4721

B-horizon soil samples were collected and analyzed for 8 elements. One hundred and six rock samples were analyzed for seven elements.

(bb) MT. MOSES Claim Gp. (474068) 21 O/8W

Confidential until August 22, 1993. The 180-claim Mt. Moses group is located approximately 77 km southwest of Bathurst. Work consisted of grid establishment (27.1 km), general prospecting, geological mapping (1:2500 scale), trenching (5 trenches totalling 289 m), reclamation of trenches, and geophysical (magnetometer, VLF EM, and horizontal-loop EM) surveys. A total of 945 B-horizon soil, 36 rock, and 4 silt samples were analyzed for 4, 5 and 7 elements, respectively.

(cc) NOWLAN LAKE Claim Gp. (474059) 21 O/8W

Confidential until July 26, 1993. This group of 121 claims is located along the Otter Brook road, approximately 20 km west of the Heath Steele mine. Work consisted of trenching (5 trenches totalling 375 m) and the collection and geochemical analysis of 119 rock and overburden samples for Cu, Pb, Zn, Ag, and Au.

(dd) THREE CORNER LAKE Claim Gp. (474051) 21 O/8W

Confidential until July 9, 1993. This 68-claim group is located approximately 50 km southwest of Bathurst. Work consisted of linecutting (36 km), general prospecting, geological mapping at 1:10 000 scale, and a magnetometer (unimag) survey. A total of 25 rock samples were collected and 18 were analyzed for Cu, Pb, Zn, Ag, and Au.

(ee) BEAR CREEK Claim Gp. (473983) 21 O/9E

Confidential until January 22, 1993. The Bear Creek group (14 claims) is located 32 km west of Bathurst. Work included soil and rock sampling, diamond-drilling, magnetometer and VLF surveys, and a compilation of previous work.

(ff) PROJECT 237 CARIBOU ROAD Claim Gp. (474022) 21 O/9E

Confidential until April 15, 1993. This 60-claim group is located 30 km southwest of Bathurst. Work on the group consisted of soil sampling and overburden surveys.

(gg) BASS RIVER Claim Gp. (474124) 21 P/5E

Confidential until December 19, 1993. This block of 145 claims is located 2 km east of Highway 8 and north of Highway 360. This report details the results of a geophysical survey (magnetometer, moving-loop TEM), a seismic reflection survey, and one follow-up drill hole.

(hh) LAWSON BROOK Claim Gp. (474135) 21 P/5E

Confidential until January 8, 1994. The Lawson Brook group comprises 79 claims and is 28 km south of Bathurst. Taylor Brook Road transects the claim block. Work in 1991 included soil geochemical (B-horizon) and geophysical (magnetometer, HLEM) surveys.

(ii) MALIAGET BROOK Claim Gp. (474119) 21 P/5E

Confidential until December 11, 1993. This 77-claim property is located 1 km west of

Highway 8 and 5 km south of the intersection of Highway 360 and the Taylor Brook road. Work in 1991 comprised a magnetometer survey (40 line-kilometres).

(jj) 249-PABINEAU SOUTH Claim Gp. (474013) 21 P/5W

Confidential until March 22, 1993. This 47-claim property is 5 km southeast of the No. 3 shaft on the Brunswick No. 12 mine site. Work in 1990 comprised linecutting and a geophysical programme that included magnetometer, VLF EM, and Max-Min surveys.

(kk) MCKAY BROOK Claim Gp. (474141) 21 P/5W

Confidential until January 17, 1994. This property, consisting of 24 claims, is approximately 32 km south of Bathurst and is transected by the Canadian National Railway's Heath Steele line. Work comprised preliminary geophysical and soil geochemical surveys.

(ll) NEPISIGUIT BROOK Claim Gp. (474028) 21 P/5W

Confidential until April 24, 1993. The Nepisiguit Brook property (71 claims) is located 39 km southwest of Bathurst. Work in 1990 included collection and analysis of 78 soil samples, a magnetometer survey, excavation of pits to expose bedrock, and diamond-drilling (hole NE-90-1).

(mm) PROJECT 101–NO. 6 CROWN GRANT (474004) 21 P/5W

This report was released to the public on Mar. 4, 1991. It describes work performed from January 1985 to December 1986 and includes the results of a borehole Pulse-EM survey carried out on holes B-343, B-346, and B-348. Only one promising conductor was located.

(nn) RAILROAD Claim Gp. (473998) 21 P/5W

Confidential until February 14, 1993. This property, comprising 49 claims, is 6.4 km southeast of the Heath Steele mine. Work included collection and analysis of till samples and grab samples.

(oo) SABINA Claim Gp. (474101) 21 P/5W

Confidential until November 15, 1993. This block of 159 claims is 32 km southwest of Bathurst. Work included soil geochemical surveys (C-horizon), a Pionjar sampling programme, trenching (891 m), diamond-drilling (1285 m), geophysical surveys (UTEM and down-hole EM), and geological mapping.

(pp) SPUR Claim Gp. (474027) 21 P/5W

Confidential until April 24, 1993. Line cutting, soil geochemical and geophysical surveys (magnetometer, VLF EM, HLEM) were carried out on this 76-claim property, located south of the Brunswick No. 12 mine and west of the Brunswick No. 6 property.

(qq) TAYLOR BROOK Claim Gp. (474080) 21 P/5W

Confidential until September 25, 1993. This 93-claim property is midway between the Brunswick No. 6 property and the Heath Steele mine. Work consisted of geophysical surveys (magnetometer, and VLF EM) and geological mapping.

(rr) ARSENEAU ROAD–234 Claim Gp. (474020) 21 P/12W

Confidential until April 5, 1993. This 40-claim group is located approximately 40 km southwest of Bathurst. Work on the property included re-establishment of a grid and a compilation of previous work.

8. WAYNE CARROLL

(a) STRIKE Claim Gp. (474113) 21 I/13W

This group of 8 claims is located approximately 30 km west-southwest of Newcastle. The property is underlain by quartz-feldspar porphyry, siltstone, chert and sericite and chlorite schists of the Ordovician Tetagouche Group. Work consisted of general prospecting, trench clearing, and a lithogeochemical survey. A total of 14 rock samples were analyzed, yielding values up to 5680 ppm Cu, 44 ppm Pb, 3840 ppm Zn, 4.32 ppm Ag, 865 ppb Au, 41 ppm As, and 4.4 ppm Sb. A geophysical survey and possibly trenching were recommended.

(b) KAKALDUCAS Claim Gp. (474018) 21 P/12W

This 22-claim group is located approximately 20 km southwest of Bathurst. The work, carried out by Northeast Exploration Services Limited of Bathurst, consisted of line installation and VLF and magnetometer surveys. Several VLF anomalies in areas of low magnetic relief were outlined. Follow-up prospecting was recommended in the vicinity of these anomalies.

10. ROBERT CONNOR

HOWLAND RIDGE Claim Gp. (474103) 21 J/3E

The 5-claim Howland Ridge group, 9 km north of the Village of Millville, covers a prospect underlain by volcanic and sedimentary rocks of the Ordovician Tetagouche Group. Soil geochemical, electromagnetic (Geonics EM 31), magnetic, and seismic refraction surveys were conducted on the property. Well-defined base-metal-sulphide anomalies were delineated in the western part of the claim group. These anomalies coincide approximately with the EM anomaly.

12. EAST WEST CARIBOU MINING LIMITED

WOODSIDE BROOK Claim Gp. (474055) 21 O/9W

This 50-claim group is 80 km west of Bathurst. Work consisted of geologic mapping over the seven northernmost claims. The report concluded that there is potential for the mineralized Caribou mine horizon to be repeated in this area. In addition to the mapping, design and test work for the Caribou mine tailings ponds are described in the appendix of the report.

13. FALCONBRIDGE LIMITED

(j) DEVILS ELBOW Claim Gp. (474063) 21 O/8W

Confidential until August 12, 1993. The property consists of 68 claims located 65 km southwest of Bathurst. Work consisted of general prospecting, 1:10 000 scale geological mapping, and trenching (3 trenches totalling 250 m). A total of 94 rock samples were collected from outcrop, trenches and Department of Natural Resources and Energy drill core. Fifty-four rocks were analyzed for sixteen elements plus Rb, Sr, Ni, Cu, and Zn by x-ray fluorescence spectrometry. Forty rocks were analyzed for 23 oxides and metals plus Au, by ICP-AES. Thin sections were prepared from 37 samples and petrographic descriptions were completed for 31 of them.

(k) FRONSAC Claim Gp. (474062) 21 O/8W

Confidential until August 12, 1993. The 31-claim Fronsac group is located approximately 65 km southwest of Bathurst. Work consisted of 1:10 000 scale geological mapping and general prospecting. A total of 10 rock samples were analyzed for 16 elements plus Rb, Sr, Ni, Cu, and Zn by x-ray fluorescence spectrometry. Four thin sections were made.

(l) HALFMILE LAKE Claim Gp. (473987) 21 O/8W

Confidential until January 24, 1993. The Halfmile Lake group of 30 claims is approximately 70 km southwest of Bathurst. Work consisted of geological mapping (1:250 scale) and trenching (5 trenches totalling 380 m). Five rock samples were analyzed for 16 elements plus Rb, Sr, Ni, Cu, and Zn by x-ray fluorescence spectrometry. A total of 22 rock samples were analyzed for 23 oxides and metals plus Au by ICP-AES.

(m) HALFMILE LAKE Claim Gp. (474122) 21 O/8W

Confidential until December 19, 1993. This 30-claim group is located approximately 70 km southwest of Bathurst. A survey to tie in the 1956 Texas Gulf diamond-drilling to the property boundary and Noranda's current drilling plan were completed. Property reclamation (i.e., backfilling of trenches excavated in 1990) was also completed.

(n) NEPISIGUIT Claim Gp. (474064) 21 O/8W

Confidential until August 12, 1993. The Nepisiguit group (464 claims) is located approximately 65 km southwest of Bathurst. Work included general prospecting and 1:10 000 scale geological mapping. A total of 78 rock samples were analyzed for 16 elements plus Rb, Sr, Ni, Cu, and Zn by x-ray fluorescence spectrometry. Thirty-nine thin sections were made and petrographic analysis was performed on thirteen of these samples.

(o) NEPISIGUIT RIVER Claim Gp. (474088) 21 O/8W

Confidential until October 24, 1993. This property, consisting of 464 claims registered under 3 claim index numbers, is located approximately 65 km southwest of Bathurst. Work consisted of general prospecting, and geological mapping (1:10 000 scale). A total of 33 rock samples were collected and analyzed for 11 oxides and 6 trace elements plus Cu, Zn, Pb, Ni, Co, and S by x-ray fluorescence spectrometry.

(p) NORTHEAST OPTION #2 Claim Gp. (474102) 21 O/8W

Confidential until November 19, 1993. This 21-claim property consists of the Tower group and the Devils Elbow group. Work consisted of general prospecting and geological mapping (1:10 000 scale). Three rock samples were collected and analyzed for 11 oxides and 9 trace elements by x-ray fluorescence spectrometry.

16. DONALD GRAHAM

HEADWAY NORTH Claim Gp. (474109) 21 P/5W

The Headway North property comprises 10 claims. It is 2.5 km southwest of the No. 3 shaft at the Brunswick No. 12 mine. Work performed in 1990 was an extension of the more extensive 1989 programme (see 473951 in Information Circular 91-1). One additional set of water and silt samples was collected. Maple tree sap was sampled and analyzed for metals. Additional C-horizon soil samples were collected and geophysical surveys were extended to the north in order to further outline the Headway sulphide body. Follow-up prospecting and pit excavation were completed and one new trench was dug.

17. IAN GRAHAM

HEADWAY Claim Gp. (474108) 21 P/5W

This 19-claim group is 3 km southwest of the Brunswick No. 12 mine. The Headway deposit outcrops on this property. At surface, it comprises a 1000 m x 1 m, north-striking, massive sulphide body. Work in 1990 included a final set of water and silt samples, maple sap samples for metal content, 3 trenches across the southeastern part of the sulphide body, and magnetometer and VLF EM geophysical surveys over part of the grid. In addition, 27 casings from earlier drill holes were located. Results of the 1991 campaign indicate the presence of a ferruginous chert band near the southwest corner of the property. The source of a nearby arsenic anomaly has not yet been determined.

18. GRANGES INC.

(a) AIRSTRIP Claim Gp. (474038) 21 O/1E

Confidential until May 21, 1993. The Airstrip group (83 claims) is located 60 km southwest of Bathurst. Work on the property consisted of a soil sampling programme.

(b) CHESTER NORTH Claim Gp. (474012) 21 O/1E

The report details the results of a two-day prospecting programme undertaken on one claim in the area of the Chester deposit, 63 km west-northwest of Newcastle. A re-examination of a 1988 soil survey was also carried out. Six pits were dug to examine bedrock beneath the till cover. Unfortunately, bedrock was never reached. No further work was recommended.

(c) CLEARWATER LAKE Claim Gp. (474037) 21 O/1W

Confidential until May 21, 1993. This 88-claim group is located 60 km northwest of Newcastle. Work consisted of prospecting and diamond-drilling.

(d) MALISEET MOUNTAIN Claim Gp. (474036) 21 O/8W

Confidential until May 21, 1993. The property consists of 145 claims located approximately 90 km southwest of Bathurst. Work included diamond-drilling (16 holes totalling 1573.7 m). Drill core samples were assayed for Cu, Pb, Zn, Ni, Ag, and Au.

19. BARRY HACHEY

FOGANS LAKE Claim Gp. (474029) 21 O/8E

Confidential until May 2, 1993. This group comprises 4 claims and is located 40 miles southwest of Bathurst. Work on the property consisted of general prospecting and sampling. Of the 35 rock samples collected, 18 were analyzed with results showing anomalous values of Pb, Zn, and Ag. Future work on the property is recommended.

20. WILFRED HACHEY

DR. W.P. Claim Gp. (474096) 21 O/7E

This 30-claim group is near Upsalquitch Lake, approximately 65 km west-southwest of Bathurst. Work consisted of general prospecting, a gravity survey, and a stream-silt geochemical survey (50 samples) to explore for massive sulphides. The gravity survey failed to delineate any appreciable sulphide occurrence. Twenty-five stream-silt samples were analyzed, yielding values up to 64 ppm Cu, 652 ppm Pb, 762 ppm Zn, 109 ppm As, 0.5 ppm Ag, 3.8 ppm Sb, and 15 ppb Au.

21. HEATH STEELE MINES LIMITED

MINE ROAD Claim Gp. (473989) 21 O/8E

Confidential until January 29, 1993. The Mine Road group, consisting of 20 claims, is located approximately 6 km southeast of the Heath Steele mill complex. Work included geological mapping, prospecting, and till sampling. All 18 of the till samples collected were analyzed for Cu, Pb, Zn, Ag, Au, As, and Sb through Pionjar drilling.

25. JAMES KELLY

BRUNSWICK EXTENSION Claim Gp. (473990) 21 P/12W

This 180-claim group is approximately 18 km south of Bathurst and 3 km north-northeast of the Brunswick No. 12 mine. Work on the property included the establishment of 60 km of cut

grid lines and geologic mapping at 1:10 000 scale over the entire group. A total of 33 chip samples were taken from mineral occurrences on the grid and were analyzed for Pb, Zn, and Au. The highest values obtained were 221 ppm Pb, 335 ppm Zn, and 71 ppb Au. VLF and magnetometer surveys were carried out over 51.5 km of line. The VLF survey detected 17 anomalies. The magnetometer survey also detected several anomalies.

26. KEY ANACON MINES LIMITED

KEY ANACON MINE Claim Gp. (474121) 21 P/5E

This group comprises 84 claims and includes the Key Anacon mine site. The property is located 20 km south of Bathurst. This report summarizes the results of the water- and soil-monitoring programmes that were undertaken following the 1989 reclamation programme.

The 1989 reclamation programme included collection of soil samples and water run-off samples for analysis. A soil treatment programme was initiated and topsoil was added to the waste pile and subsequently seeded. Limestone was added to the run-off to adjust its acidity.

27. M.D. KIERANS

SPRUCE LAKE Claim Gp. (474125) 21 O/8E

This 17-claim group is about 40 km west-southwest of Bathurst and is underlain by Middle Ordovician Tetagouche Group rocks. Work consisted of compilation of previous data and relogging of core from three diamond-drill holes.

31. MAJOR GENERAL RESOURCES LIMITED

HARTTS LAKE Claim Gp. (474120) 21 O/8W

Confidential until December 13, 1993. The Hartts Lake property (30 claims) is located approximately 55 km southwest of Bathurst. A geocompilation of all available data was completed. The site was visited and the nine trenches (totalling 730 m) excavated previously were re-examined.

33. MATTAGAMI LAKE EXPLORATION LIMITED

(a) ISLAND LAKE Claim Gp. (474001) 21 O/8E

Confidential until February 22, 1993. This 35-claim group is located approximately 3 km southeast of the Heath Steele mine complex. Work comprised geochemical analysis of 32 till and 3 rock grab samples.

(b) ISLAND LAKE Claim Gp. (474090) 21 O/8E

Confidential until October 30, 1993. This claim group consists of 35 contiguous claims that

are located approximately 3 km southeast of the Heath Steele mine complex. Work consisted of 5 trenches totalling 574 m. Forty rock samples were collected and analyzed for Cu, Pb, Zn, and Au.

(c) HALFMILE LAKE NORTH Claim Gp. (474014) 21 O/8W

Confidential until March 22, 1993. This group of 18 claims is located approximately 67 km northwest of Newcastle and 20 km west of the Heath Steele mine. Work included linecutting (42.65 km), geological mapping (1 in. equals 400 ft.), trenching (2 trenches totalling 304.8 m), diamond-drilling (4 holes totalling 2728 m), and geophysical surveys (VLF, HLEM, magnetometer, and surface and down-hole transient EM). Drill core samples were assayed for Cu, Pb, Zn, and Ag. A total of 995 B-horizon soil samples were collected and analyzed for Cu, Pb, Zn, As, Ag, Sb, Bi, Co, Hg, and Ni by atomic absorption.

38. NORANDA EXPLORATION COMPANY, LIMITED

(a) STRATMAT Claim Gp. (474129) 21 O/8E

Confidential until December 17, 1993. The Stratmat group (54 claims) is located along the Stratmat haulage road that leads directly to the Heath Steele mine. Work included grid establishment (3.75 km), general prospecting, trenching (5 trenches totalling 570 m), geophysical surveys (EM and gravity), geochemical surveys (86 Pionjar and 76 trench samples), and diamond-drilling (53 holes totalling 30 147.27 m).

39. NORTHEAST EXPLORATION SERVICES LIMITED

(a) SEVOGLE GIS Claim Gp. (474050) 21 O/1E

Confidential until July 3, 1993. This block of 34 claims is 21 km southwest of the Heath Steele mine site. Work consisted of compilation and reinterpretation of stream-sediment samples and geophysical data originally gathered by the Geological Survey of Canada.

(b) SEVOGLE Claim Gp. (474100) 21 O/1E

Confidential until November 15, 1993. This 34-claim group is 21 km southwest of the Heath Steele mine site. Work consisted of collection and analysis of 204 soil samples.

(c) DEVILS ELBOW BROOK Claim Gp. (473994) 21 O/8W

This group of 12 claims is located approximately 60 km west-southwest of Bathurst. The group was staked to cover a possible exhalite horizon east of the Devils Elbow deposit. Work consisted of grid establishment (8.8 km) and VLF EM and total-field proton magnetometer surveys. Several areas of weak geophysical anomalies were unable to locate stringer sulphides, found in float trenched by Conwest in the 1970s. The report recommended an attempt to locate the area of mineralized float, followed by overburden sampling and detailed geophysical surveys.

(d) LITTLE RIVER Claim Gp. (473985) 21 P/4W, 5W

The Little River group, which encompasses 11 claims, is 10 km southeast of the Heath Steele mine. Work in 1990 included VLF EM and proton magnetometer surveys. Several anomalies were located, which appear to be along the same stratigraphic horizon as the nearby Roche Long Lac deposit (see 473884 in Information Circular 91-1). Follow-up work to delineate this horizon (soil sampling and a horizontal-loop electromagnetic survey) has been suggested.

(e) RAILROAD Claim Gp. (474052) 21 P/5W

Confidential until July 9, 1993. This 9-claim property is 9 km southeast of the Heath Steele mine site. Work comprised relogging of core and compilation of geophysical and geochemical data.

(f) RAILROAD EXTENSION Claim Gp. (474137) 21 P/5W

Confidential until January 2, 1994. The property, encompassing 12 claims, is 10 km east-southeast of the Heath Steele mine. Work during 1991 included linecutting and 15 line-kilometres of proton magnetometer and VLF geophysical surveys.

(g) ROCHE LONG LAC Claim Gp. (474024) 21 P/5W

The Roche Long Lac property (113 claims) is 10 km southeast of the Heath Steele mine site. This report comprises computerized geophysical data, originally collected by the Geological Survey of Canada, that was synthesized by means of an appropriate software programme. The results of these manipulations are described.

40. NOVAGOLD RESOURCES INC.

(c) SEARS LAKE Claim Gp. (474110) 21 O/2W

Confidential until November 29, 1993. This 162-claim group is located approximately 80 km west of Newcastle. Gradient array IP, magnetic, VLF EM, and airborne magnetic EM and VLF EM surveys were carried out. Three diamond-drill holes (totalling 185 m) were completed.

(d) CALIFORNIA LAKE Claim Gp. (474091) 21 O/8E

Confidential until October 31, 1993. The California Lake group of 72 claims is located approximately 55 km south-southeast of Bathurst. Work consisted of geological mapping (1:2500 scale) and trenching (14 trenches totalling 2520 m).

(e) CAMEL BACK MOUNTAIN Claim Gp. (474054) 21 O/9W

Confidential until July 16, 1993. This 36-claim group is located approximately 50 km west of Bathurst. Work consisted of prospecting and a silt sampling survey.

(f) SOUTH BOUNDARY Claim Gp. (474041) 21 O/9W

Confidential until May 21, 1993. This 12-claim group lies approximately 60 km west of Bathurst. Work included one diamond-drill hole with down-hole Pulse-EM and a surface Pulse-EM survey.

42. DAVID O'NEIL

FORTY FOUR MILE BROOK Claim Gp. (474107) 21 O/8E

This claim group (4 claims) is located approximately 50 km southwest of Bathurst, along the main branch of Forty Four Mile Brook. A geochemical survey was undertaken in which 41 of the 82 soil samples collected were analyzed for Cu, Pb, and Zn. Values up to 345 ppm Pb and 424 ppm Zn were obtained. Additional prospecting and a VLF survey are planned.

43. PGE RESOURCE CORP.

(a) BILLS LAKE Claim Gp. (474112) 21 O/1E

This block of 98 claims is between the north branch of the North Sevogle River and Clearwater Stream. During 1990 PGE carried out local soil sampling and follow-up trenching over geophysical anomalies. A total of 194 C-horizon tills and 51 basal tills were sampled and analyzed. Zones with anomalous values of Pb, Zn, and Cu were outlined. Magnetometer, maxi-probe EM and VLF EM geophysical surveys were also undertaken.

46. RIO ALGOM EXPLORATION INC.

(a) WEDGE NORTH Claim Gp. (474034) 21 O/8E

Confidential until May 16, 1993. This 78-claim group is located 55 km northwest of Newcastle. Work on the property included linecutting and geophysical surveys.

(b) NEPISIGUIT BROOK Claim Gp. (474073) 21 P/5W

Confidential until September 6, 1993. This block consists of 273 claims located 50 km northwest of Newcastle. Recent work on this property included geophysical surveys (borehole Pulse-EM) and diamond-drilling.

(c) STEWART OPTION Claim Gp. (473984) 21 P/5W

Confidential until January 23, 1993. The 9-claim Stewart Option group is 50 km northeast of Newcastle and 2.5 km north-northeast of the CNE deposit. Work in 1990 consisted of magnetometer and gravity surveys, and one 320 m diamond-drill hole (N-40).

47. FRANK E. ROSS

KICKBACK Claim Gp. (473997) 21 O/8E

This property consists of 14 claims that are located approximately 50 km west-southwest of Bathurst. Work consisted of compilation, prospecting, and geochemistry surveys. A total of 37 silt, 85 soil, and 8 rock samples were collected and analyzed for Cu, Pb, Zn, and Ag. Silt and soil samples contained up to 507 ppm and 805 ppm Zn, respectively.

49. SEVOGLE EXPLORATION INC.

MIDDLE RIVER 90 Claim Gp. (473993) 21 O/9E

Confidential until February 4, 1993. This 36-claim group is located approximately 32 km west of Bathurst. The work consisted of a soil survey.

50. MICHAEL SMITH

SOUTHWEST Claim Gp. (474089) 21 J/16W

The Southwest group (9 claims) is located 55 km west-southwest of Newcastle. Two diamond-drill holes (totalling 549 m) tested a new geological interpretation and strong gravity and weak IP anomalies. The holes intersected intercalated porphyritic volcanics, rhyolites, tuffs, and sediments with minor traces of base-metal sulphides. Geochemical assays of core sections yielded values up to 28 ppb Au and 2.7 g/t Ag. No cause for the positive gravity anomaly was found. The report concluded that the IP anomaly is caused by disseminated pyrite and pyrrhotite.

51. ROBERT STAIRS

CANOE LANDING LAKE Claim Gp. (474072) 21 O/8E

This 25-claim group is located 43 km southwest of Bathurst, north of Highway 430 and in the lower reaches of Forty Mile Brook. Work consisted of compilation and grid establishment (28.5 km) on those parts of the property that had little or no previous coverage. An HLEM survey is recommended over the entire property.

52. BEVERLY STEWART

MCNEAL BROOK Claim Gp. (474002) 21 J/16E

The property consists of 72 claims located approximately 39 km west-southwest of Newcastle. It is underlain by Ordovician sedimentary and volcanic rocks separated from Silurian sedimentary rocks by the Devils Brook Fault. Work consisted of linecutting (10 km), general prospecting, diamond-drilling (4 holes totalling 1303 m), and VLF EM and proton magnetometer surveys. Several broad VLF anomalies and a "birds-eye" pattern of magnetic values are interpreted to be related to mafic volcanic rocks. Isolated magnetic anomalies also occur in the northern part of the group. Diamond-drilling intersected a mineralized zone 24.7 m in length. A total of 39 drill core samples were geochemically analyzed and yielded values up to 2.88% Mn and 0.07 g/t Au. The report concluded that no significant manganese mineralization exists. Further exploration was recommended on a zinc–lead showing discovered near the north edge of the grid.

53. STRATABOUND MINERALS CORP.

(a) STRATABOUND NORTH Claim Gp. (474139) 21 O/8E

Confidential until January 14, 1994. The Stratabound North property, comprising 12 claims, is situated 1 km north of the Stratmat mine. The report summarizes the results of VLF EM-16 (11.2 km) and proton magnetometer (12.8 km) surveys, as well as a geochemical survey in which 122 soil samples were collected and analyzed for Cu, Pb, Zn, and Ag.

(b) STRATMAT NORTH Claim Gp. (473995) 21 O/8E

This property comprises 12 claims that are located 6 km northwest of the Heath Steele mine. The claims are underlain by Ordovician felsic and mafic volcanic rocks. The exploration programme consisted of chaining, geological mapping, and prospecting. A total of 17 rock and 20 silt samples were collected and analyzed for Cu, Pb, Zn, and Ag. Rock and silt samples yielded up to 278 ppm and 258 ppm Pb, and 138 ppm and 600 ppm Zn, respectively. Further exploration is planned.

(c) STRATMAT WEST Claim Gp. (474140) 21 O/8E

Confidential until January 14, 1994. This 23-claim group is located 3 km west of the Stratmat mine. Work included compilation, geological mapping, prospecting, 12.4 km of chaining, a VLF EM-16 survey (10.4 km) as well as a proton magnetometer survey over 10.4 km of the property.

(d) CAPTAIN Claim Gp. (473999) 21 P/5W

This 48-claim property is 12 km east of the Heath Steele mine site. The 1990 exploration programme included IP (18.8 line-kilometres) and magnetometer (6.5 line-kilometres) surveys, geochemical surveys (162 soil, 21 rock, and 2 silt samples), and four diamond-drill holes totalling 612 m. No additional reserves were outlined by the drilling programme. However, 4 anomalous areas were outlined for further study.

(e) CNE Claim Gp. (474044) 21 P/5W

Confidential until June 4, 1993. The CNE group, a block of 30 claims located 40 km northeast of Newcastle, hosts the CNE base-metal deposit. This report details the extraction and processing results of a bulk sample obtained in 1990 and milled at the Heath Steele mine site.

(f) CNE Claim Gp. (474097) 21 P/5W

This block of 78 claims is 40 km northeast of Newcastle. Geophysical surveys in 1990 included IP (1.6 km), VLF EM (19.5 km), and proton magnetometer (20.7 km). A total of 12 silt and 18 rock samples were collected in the vicinity of four anomalies outlined by geophysical methods. Recommendations for further work include proposals for diamond-drilling and a more extensive soil sampling programme.

54. TECK CORPORATION

BRUNSWICK EXTENSION Claim Gp. (474126) 21 P/12W

Confidential until December 23, 1993. This group of 100 claims is located 19 km southwest of Bathurst. Work consisted of a stream-sediment survey, lithogeochemical survey, geologic mapping at 1:2500 and 1:5000 scales, and follow-up trenching.

55. TECK EXPLORATION LIMITED

(a) IMHOFF Claim Gp. (474118) 21 P/12W

Confidential until December 9, 1993. This 18-claim group is located 18 km southwest of Bathurst. Work consisted of linecutting together with VLF, magnetometer, and stream-sediment surveys.

(b) KAKALDUCAS Claim Gp. (474117) 21 P/12W

Confidential until December 9, 1993. The Kakalducas group (22 claims) is located 18 km southwest of Bathurst. Work consisted of linecutting, VLF and magnetometer surveys, and stream-sediment surveys.

57. CLAUDE WILLETT

(c) HALFMOON LAKE Claim (474098) 21 O/8E

This one-claim property is located approximately 60 km southwest of Bathurst. Work included linecutting (0.8 km) and a gravity survey (1 km) over a VLF conductor that had been located in 1990.

(d) JEANNE MANCE Claim Gp. (474087) 21 P/6W

This 11-claim property straddles Highway 8 north of the Tabusintac River. From June to August of 1991, a 750-sample soil geochemistry survey (Cu, Pb, Zn, Au) and geophysical (VLF, magnetometer) surveys were undertaken in the area around the Jurassic Caraquet Dike. Gossanous zones are present along the dike.

(e) TABUSINTAC Claim Gp. (474023) 21 P/6W

This property consists of 11 claims that straddles Highway 8 north of the Tabusintac River. The Jurassic Caraquet Dike transects the property, which was staked on the basis of anomalous Cu and Zn values in local tills. Prior to May 1991, nine trenches were dug across the dike and samples were obtained for analysis. An oxidized zone that continues for 183 m along the south side of the dike has been outlined.

FREDERICTON ZONE

6. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(ss) SPRINGFIELD Claim Gp. (474078) 21 J/3E

Confidential until September 17, 1993. This 33-claim group covers a gold- and antimony-bearing, brecciated, and quartz-veined deposit that cuts across Silurian wacke and slate, 25 km north of the City of Fredericton. The Silurian strata occur in the northeastern contact aureole of the Pokiok Batholith, which is composed of Late Silurian to Devonian granodiorite and granite. Soil geochemical, VLF EM, and magnetic surveys were conducted on the property. Trenching and diamond-drilling were carried out to delineate the mineralized vein.

ST. CROIX ZONE

6. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(tt) LITTLE MCDOUGALL LAKE Claim Gp. (474070) 21 G/7E

Confidential until August 26, 1993. The 92-claim Little McDougall Lake group extends from the north end of South Oromocto Lake to immediately southwest of Little McDougall Lake, and north of the Saint George Batholith. The area is underlain by Ordovician/Silurian metasedimentary and volcanic rocks intruded by Devonian granite. MEX Exploration Ltd. delineated a silicified zone with anomalous tungsten, molybdenum, and base-metal sulphides in the area. An exploration programme including soil geochemical, magnetometer and VLF EM surveys was conducted on the property.

9. COBRUN MINING CORPORATION

ST. STEPHEN NICKEL Claim Gp. (474021) 21 G/3W

Confidential until April 9, 1993. The 57-claim St. Stephen Nickel group covers the main nickel–copper–cobalt deposits in the northern part of the St. Stephen mafic–ultramafic complex, in southwestern New Brunswick. A consulting company engaged by Cobrun developed a leaching process to recover various metals from the St. Stephen ores.

14. GOLDFLUOR EXPLORATION LIMITED

JIMMY HILL Claim Gp. (474008) 21 G/7E

This 23-claim group covers a prominent gold prospect north of the Saint George Batholith

and east of South Oromocto Lake. The claim group covers Silurian hornfelsic metasediments that are intruded by Devonian granite. Numerous gold-bearing quartz veins, varying in width from 30 cm to 1 m, cut across the metasediments. One set of veins strikes 020° to 060° and dips 50° south. A second set strikes 320° and appears to be the youngest. A previous grab sample representative of this vein material yielded 5.9 g/t Au. Recent rock sampling produced assays up to 15 740 ppb Au, 5150 ppm W, and 5150 ppm Sb. Eleven rock chips collected along the northwest boundary yielded up to 238 ppb Au. A detailed geophysical survey, soil sampling, trenching, and diamond-drilling are recommended for the property. It is possible that this work will delineate a mineralized zone amenable to open pit mining.

56. K.D.A. Whaley

PLEASANT RIDGE Claim Gp. (474067) 21 G/7W

This 4-claim group covers a highly fractionated Devonian granite stock and the surrounding contact aureole at Pleasant Ridge, 5 km west of Mount Pleasant. A vein composed of sphalerite and tin minerals was discovered in this area by MEX Exploration Ltd. (Shell Canada Ltd.) in 1982. Rock sampling yielded the following results: *Trench 2* intersected 0.7 m assaying 15.5% Zn and 0.98% Sn; 1.8 m assaying 9.02% Zn and 0.98% Sn; and 2.0 m assaying 1.5% Zn and 1.35% Sn. *Trench 3* intersected 2.7 m assaying 6.25% Zn and 1.04% Sn. *Trench 4* intersected 1.5 m assaying 9.21% Zn and 0.59% Sn; and 1.1 m assaying 8.21% Zn and 0.78% Sn. Prospecting in the area resulted in the discovery of numerous mineralized boulders in addition to sulphides exposed in the trenches.

MASCARENE ZONE

6. Brunswick Mining and Smelting Corporation Limited

(uu) BONAPARTE LAKE Claim Gp. (474076) 21 G/3E

Confidential until September 13, 1993. This group (120 claims) covers most of the Bocabec Complex, which constitutes the western extension of the Saint George Batholith. The Bocabec Complex consists of mainly gabbro that is intruded by small granitic stocks. Narrow gold- and arsenopyrite-bearing quartz–carbonate veins occur locally in the complex. A grid was established over the property, the ground was prospected, regolith and B- and C-horizon soils were sampled, and VLF EM and magnetic surveys were carried out.

11. Costigan Gold Corporation

EVANDALE Claim Gp. (473996) 21 G/9E

Confidential until February 12, 1993. This 70-claim group covers an extensive

copper–molybdenum–gold zone in the northwestern part of a Devonian granodiorite stock, which outcrops immediately west and northwest of Evandale. The stock intrudes Silurian sedimentary and volcanic rocks. Mineralized fractures and quartz stringers carrying pyrite, chalcopyrite, molybdenite, and gold occur in a zone about 500 m wide and 2700 m long. Scheelite-bearing veins are locally associated with the mineralized zone. A limited amount of trenching was done and four short holes were drilled by Costigan during 1990–1991.

ANNIDALE–BEULAH ZONE

4. BP Resources Canada Ltd.

(a) TAYLOR BROOK and STEWARTON Claim Gps. (474056 and 474057) 21 H/12W

Both reports confidential until July 9, 1993. The Taylor Brook (9 claims) and Stewarton (130 claims) groups are west and north of the community of Stewarton, 25 km west of the Town of Sussex. The claims lie within intensely faulted, metavolcanic and metasedimentary rocks of the Ordovician Annidale Group. Prospecting, VLF EM and magnetic surveys, trenching, and diamond-drilling were conducted in 1990 on the properties. Exploration of gossanized quartz–carbonate vein systems in the trenches yielded up to 3.3 and 4.7 g/t Au. More prospecting, soil sampling, and trenching were carried out in 1991.

(b) KETCHUM BROOK Claim Gp. (474000) 21 H/12W

The Ketchum Brook group (161 claims) is immediately southeast of BP's Taylor Brook and Stewarton claim groups. The area includes major fault zones that separate: (1) the Ordovician Annidale Group and the Ordovician and/or older Queen Brook Formation, and (2) the Queen Brook Formation and Cambrian volcanic rocks. Gold-bearing quartz–carbonate shear zones are associated with these major faults. Prospecting resulted in the discovery of a boulder containing about 15% pyrite, 1–2% chalcopyrite and anomalous amounts of gold. Soil sampling delineated four zones of zinc enrichment that coincided with conductors delineated by VLF EM.

28. LAC Minerals Limited

ANNIDALE #1 Claim Gp. (474115) 21 H/13W

Confidential until December 9, 1993. This 27-claim group is at Annidale, 25 km west of the Town of Sussex. The area is underlain by mafic and felsic volcanic and sedimentary rocks of the Ordovician Annidale Group. Rhyolite domes with associated proximal breccias are part of the felsic volcanic sequence. The rhyolites are correlatives of similar felsic rocks that host the Harborside massive sulphide deposit along the east side of Penobscot Bay, in Maine. The Harborside deposit has characteristics of Kuroko-style mineralization. The mafic volcanic rocks at Annidale host the Annidale copper deposit that has characteristics of Beshi-style mineralization.

The Annidale copper deposit contains little or no lead or zinc sulphides. In 1991, an IP survey was conducted over part of the property and two short holes were drilled.

38. NORANDA EXPLORATION COMPANY, LIMITED

(b) HENDERSON SETTLEMENT Claim Gp. (473991, 474086) 21 H/12W

This 120-claim group is immediately east of the community of Henderson Settlement and extends south to Scotch Settlement, 6 km north of the eastern end of Belleisle Bay. The Falls Brook–Taylor Brook Fault separates the Ordovician Annidale Group in the northern part of the property from the Queen Brook Formation to the south. The Annidale Group is dominated by mafic and felsic volcanic rocks and graphitic pelitic metasediments. The Queen Brook Formation is characterized by thinly bedded, greyish green sandstone and siltstone with locally intercalated mafic and felsic volcanic rocks. The property was prospected, the geology was mapped in detail, soils were sampled and a VLF EM survey was carried out over part of the property. Five trenches were excavated to check the significance of geochemical and geophysical anomalies. Initial prospecting along Henderson Brook led to the discovery of a mineralized quartz-vein system. One 20-cm-wide quartz vein in this system assayed 1069 g/t Ag. Soil sampling subsequently revealed several As±Au soil anomalies along a prominent shear zone that parallels Henderson Brook. Soils with highly anomalous Sb, As, Ag, and Au occur in the southwestern part of the claim group. VLF EM and magnetic surveys are planned in the area of the anomalies to guide further exploration.

43. PGE RESOURCE CORP.

(b) DEVIL PIKE Claim Gp. (474009) 21 H/12W

The Devil Pike group (54 claims) is immediately west of the small community of West Scotch Settlement. The property is mostly underlain by mafic and felsic volcanic and sedimentary rocks of the Ordovician or older(?) Queen Brook Formation. In the southern part of the property, the Queen Brook Formation is, in part, overlain by the Silurian Henderson Settlement beds. The company conducted a basal till geochemical survey and a limited amount of Winky drilling. One drill hole in the northwestern part of the property intersected 1.77% Cu over 2.1 m in the Queen Brook Formation. Boulders containing pyrite and sphalerite were found on the property by prospector Robert Baxter. The discovery of base-metal sulphides in the Queen Brook Formation is significant because these rocks are interpreted to be the correlatives of the Ellsworth Formation in Maine that hosts the Black Hawk massive sulphide deposit.

48. SEABRIGHT EXPLORATION INC.

ANNIDALE Claim Gp. (474095) 21 H/13W

Confidential until November 5, 1993. This 60 claim group is at Annidale, 25 km west of the Town of Sussex. The area is underlain by mafic and felsic volcanic and sedimentary rocks

of the Ordovician Annidale Group. Rhyolite domes with associated proximal breccias are part of the felsic volcanic sequence. The rhyolites are correlatives of similar felsic rocks that host the Harborside massive sulphide deposit along the east side of Penobscot Bay in Maine. The Harborside deposit has characteristics of Kuroko-style mineralization. The mafic volcanic rocks at Annidale host the Annidale copper deposit that has characteristics of Beshi-style mineralization. The Annidale copper deposit contains little or no lead or zinc sulphides. A silicified and carbonatized shear zone immediately adjacent to the Annidale copper deposit yielded a drill hole intersection that assayed 3.1 g/t Au over 1.7 m. An extensive intensely altered zone characterized by abundant carbonate and chrome mica southwest of the Annidale deposit contains up to 6.38% combined lead and zinc, but only minor copper (in contrast with the Annidale copper deposit). In 1991, the geology of the property was remapped and available drill cores were relogged.

CALEDONIA ZONE

13. FALCONBRIDGE LIMITED

(q) ROSEVALE Claim Gp. (473988) 21 H/15W

Confidential to January 24, 1993. This 100-claim group is 20 km southwest of the Village of Hillsborough in southeastern New Brunswick. The property is underlain by Precambrian mafic and felsic volcanic rocks that are intruded by the Weldon Creek Gabbro. A total of 87 rock samples and 5 stream-sediment samples were collected for chemical analysis.

15. MORTON GORDON

(a) ELLIOT ROAD Claim Gp. (474145) 21 H/5W

This 15-claim group covers high-calcium limestone deposits between the Village of Quispamsis and French Village between Highways 1 and 860 and immediately south of Hammond River. The area is underlain by the Ashburn Formation of the Precambrian Greenhead Group. The Ashburn Formation consists of dolomitic limestone with interbedded quartzite and pelite. A sampling programme yielded assays of 48.9% to 51.1% CaO and 2.74% to 3.47% MgO.

(b) BONNEY ROAD Claim Gp. (474060) 21 H/5W

The Bonney Road group of 18 claims is east of the Village of Nauwigewauk between Highways 1 and 860. The area is underlain by the Ashburn Formation of the Precambrian Greenhead Group. The Ashburn Formation consists of dolomitic limestone with interbedded quartzite and pelite. A sampling programme was undertaken on the property.

36. MISPEC RESOURCES INC.

CAPE SPENCER Claim Gp. (474015) 21 H/4W

This 63-claim group is 15 km southeast of the City of Saint John, along the Bay of Fundy coast. The area is underlain by Precambrian volcanic and granitoid rocks that are thrust over Carboniferous or older sedimentary rocks. Extensive alteration zones associated with the thrust zone contain pyrite–gold deposits. Illite is the main alteration mineral. Geophysical surveys (IP, magnetic susceptibility, gamma-ray spectrometry), soil geochemical surveys, and diamond-drilling were carried out in 1990. The diamond-drilling programme conducted by the company in 1991 was designed to test new exploration targets defined by geophysical and geochemical surveys conducted in 1990.

MONCTON–CUMBERLAND BASIN

6. BRUNSWICK MINING AND SMELTING CORPORATION LIMITED

(vv) CEDAR CAMP Claim Gp. (474099) 21 H/11W

Confidential until November 15, 1993. The Cedar Camp group (28 claims) is 13 km east of the Village of Sussex Corner. A carbonate-hosted galena and sphalerite occurrence and a lead–zinc soil anomaly east of this occurrence were discovered on the property in the early 1960s. The first exploration work on the property was done at that time by McIntyre Porcupine Mines Ltd. and on adjacent ground by Vi-Nor Exploration Ltd. The 1991 work consisted of soil sampling, an IP survey, and trenching.

32. MARITIME RESOURCE RESEARCH LIMITED

GLEBE MINE Claim Gp. (474030) 21 H/11W

Confidential to May 6, 1993. This group of 4 claims is immediately west of Poley Mountain and 15 km southwest of the Town of Sussex. The prospect is underlain by limestone of the Carboniferous Windsor Group. A sampling programme for base-metal sulphides was conducted on the property. The basal Windsor Group has potential for Mississippi-Valley- or Gays-River-type (N.S.) lead–zinc deposits.

METALLIC MINERAL DEPOSITS

Annidale Gold, Base-metal Deposit 21 H/13W

LOCATION The Annidale deposit is approximately 2 km south of Annidale, Kings County (Figure 14).

COMPANY LAC Minerals Limited. Head Office: 21st Floor, Box 156, North Tower, Royal Bank Plaza, Toronto, Ontario M5J 2J4. Telephone: (416) 865-0722.

RIGHTS LAC Minerals Limited holds 60 contiguous claims under the Mining Act, Chapter M-14.1, S.N.B. 1985. The Annidale deposit is within this group.

HISTORY Copper sulphides were first found in the Annidale area around 1900. Between 1902 and 1922, several short shafts and pits were sunk into the deposit. Around 1920, two carloads of high-grade copper ore were sold from the mine. American Metals Mining Company and New Brunswick Copper Corp. drilled part of the deposit between 1951 and 1955. Cities Services Mineral Corporation uncovered part of the deposit in 1969. In addition, this company discovered an intensely altered mafic igneous complex cut by numerous quartz–gold carbonate veins in the western part of the property. Low-grade gold, up to 2.4 g/t, was found locally in samples collected by M.J. Grant and W.J. Walton. In 1983 and 1986, the property was optioned by Minerais Lac Ltée and diamond-drilling was carried out in the gold-bearing chromium-mica zone. The base-metal-sulphides that were intersected locally contained silver and low-grade gold.

In 1988, LAC Minerals Limited collected and analyzed 170 basal till samples, and analyzed samples of core from the Sussex Regional Office core repository. In 1989, the company conducted an IP survey over areas with anomalous gold, silver, copper, lead, and zinc values in soils. Seven short holes were drilled to test the IP anomalies. All holes intersected intensely sheared and altered sedimentary and volcanic rocks. One hole intersected 3.12 g/t Au over 1.52 m. The host rocks are intensely carbonatized, silicified, and chloritized. Chrome mica alteration also was intersected in the hole. Inco Gold Company optioned the property in 1989 and conducted a trenching and diamond-drilling programme. Following this discovery, BP Resources Canada Limited, Brunswick Mining and Smelting Corporation Limited, PGE Resource Corp., and Maritime Resource Research Ltd. staked extensive groups of claims in this area. They conducted till geochemical and electromagnetic surveys, trenching, and diamond-drilling on their claim groups, but much of the information remains confidential.

GEOLOGY Recent geologic mapping and radiometric dating have shown that most of the southern St. Croix zone is underlain by intensely deformed Ordovician mafic and felsic volcanics and sedimentary rocks. This has made the area attractive not only for gold, but also for base-metal sulphides. Many companies and prospectors actively explored the complex faulted boundary between the southern St. Croix and northern Caledonia zones. In the South Oromocto Lake area, gold-bearing shear and fracture zones were found in metasedimentary rocks along the contact of

Middle Devonian granodiorite intrusions. At Sand Brook Mountain, William Carter found a gold-bearing outcrop assaying 7.5 g/t gold. Till geochemical and electromagnetic surveys and trenching by Brunswick Mining and Smelting Corporation Limited delineated an extensive northeast-striking, mineralized shear zone on this property. Grand Empire Exploration Limited conducted a diamond-drilling programme on its claims in the area. At Jimmy Hill, Goldfluor Exploration Limited found several gold-bearing quartz veins. Chip samples across one of the veins and into the wall rocks assayed, respectively, 8.95 g/t gold over 1.3 m, 4.25 g/t gold over 1.3 m, and 17.18 g/t gold over 20 cm. In the Little McDougall Lake area, Brunswick Mining and Smelting Corporation Limited staked claims in Ordovician metasediments and rhyolite tuff. Similar rocks along strike in the State of Maine host the Blue Hill base-metal sulphide deposit.

The area is underlain by mafic and felsic volcanic and sedimentary rocks of the Ordovician Annidale Group. Rhyolite domes with associated proximal breccias are part of the felsic volcanic sequence. The rhyolites are correlatives of similar felsic rocks that host the Harborside massive sulphide deposit along the east side of Penobscot Bay in Maine. The Harborside deposit has characteristics of Kuroko-style mineralization. The mafic volcanic rocks at Annidale host the Annidale copper deposit that has characteristics of Beshi-style mineralization. The Annidale copper deposit contains little or no lead or zinc sulphides. A silicified and carbonatized shear zone immediately adjacent to the Annidale copper deposit yielded a drill hole intersection that assayed 3.1 g/t Au over 1.7 m. An extensive intensely altered zone characterized by abundant carbonate and chrome mica southwest of the Annidale deposit contains up to 6.38% combined lead and zinc, but only minor copper (in contrast with the Annidale copper deposit).

The deposit dips 40–70° northwest and was traced along strike for 240 m. It was drilled to a depth of about 60 m. The width ranges from a few centimetres to about 2.5 m. The main copper sulphides are chalcopyrite and bornite, which occupy voids and fractures in brecciated pyrite. A rather unusual alteration zone with disseminated pyrite, minor sphalerite and galena, and trace amounts of silver and gold were found just south of the Annidale deposit.

RESERVES Drill-indicated reserves (1983) are about 90 000 t grading 2–7% copper. It also contains about 4 g/t Ag for each per cent of copper. This tonnage may be increased when the limits of the deposit are determined by additional drilling.

DEVELOPMENTS In 1991, the geology of the property was remapped and available drill cores were relogged.

Cape Spencer Gold — 21 H/4W

LOCATION The Gordex Minerals Limited gold property is located at Cape Spencer, 15 km southeast of the City of Saint John, along the Bay of Fundy coast (Figure 14).

COMPANY Gordex Minerals Limited, P.O. Box 7071, Station A, Saint John, N.B. E2L 4S5. The President is Mr. Morton Gordon.

RIGHTS The property, held in the name of Gordex Minerals Limited, consists of 36 mineral claims held under the Mining Act, Chapter M-14.1, S.N.B. 1985. The central part of the property was formerly Mining Licence 1371.

HISTORY Minor amounts of gold were found near the lighthouse several years ago. The property was staked in 1979–80 by Mr. Morton Gordon. An intensive exploration programme conducted during the summer of 1982 led to the delineation of an extensive alteration zone with numerous gold-bearing quartz veins. Gordex Minerals Limited mined 30 000 t of ore from its surface workings on the Cape Spencer gold deposit in 1985 and has received permission from the appropriate provincial departments to operate a 30 000 t demonstration plant to leach gold from the ores. In addition, another 15 000 t was placed on the heap-pad in 1986. The leaching of the gold with $Ca(CN)_2$ was carried out in the summer of 1986 and the recovery of gold from the demonstration heap leach was successful. At the end of the year, Gordex was carrying out a substantial exploration programme to confirm ore reserves in the Cape Spencer area. During 1987 several modifications were made to the gold extraction procedure at Cape Spencer. The heap leaching operation was converted to an earthen vat leaching process. This provides a better means of controlling extraneous water from diluting the leach cycle. At the same time the gold extraction mechanism was converted from a zinc precipitate to a carbon-in-pulp treatment. Both these changes have resulted in better recoveries of gold.

Additional interest in the operation was sparked by a drilling programme initiated by Gordex, which indicated a gold mineralization zone approximately 130 m wide with a strike length of 160 m, open at a depth of 95 m to 210 m. Intersections from the 11 holes drilled graded 6.17 g/t Ag (cut grade) over an average width of 5.6 m.

Gordex Minerals Limited continued to treat ore at its Cape Spencer mine in 1989. However, no mining was performed during the year. Low gold prices forced the company to discontinue full operation. This resulted in the termination of most of the workforce and operating management. Only a few employees were retained to carry out leaching and waste-water treatment.

A cease-trading order was issued in July, 1989, because of the company's failure to file audited financial statements.

RESERVES (Published) 671 328 t of ore, grading 3.3 g/t Au, has been outlined on the property to a depth of 152 m. The property has potential reserves of 3 000 000 t.

DEVELOPMENTS Gordex continues to seek a partner to share in the cost of exploring areas on the property with indicated potential. Drilling in 1988 demonstrated that there was gold mineralization to the north of the area that has been mined. However, the present financial situation appears to be discouraging likely partners from investing in exploration of the zone.

Attempts are presently underway to make the property more attractive to potential investors and improvement in the price of gold may help Gordex to obtain financial backing. At this time there is no activity at the site.

Halfmile Lake Zinc, Lead, Silver, Copper 21 O/8W

LOCATION The Halfmile Lake deposit is 19 km west of the Heath Steele mine, in Northumberland County. It is accessible via Highway 430 and secondary roads (Figure 14).

COMPANIES Falconbridge Limited, Noranda Exploration Company, Limited, and Mattagami Lake Exploration Limited.

RIGHTS In 1991, the property consisted of 73 mineral claims held as three separate groups of 30, 25, and 18 claims, respectively, by Falconbridge Limited, Noranda Exploration Company, Limited, and Mattagami Lake Exploration Limited. The Upper AB Zone (the Kidd Creek Mines Ltd. part of the deposit) lies within the Falconbridge portion of the property, the Lower AB Zone (the Conwest part) within the Noranda portion, and the Main Zone within the Mattagami portion. The claims are held under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Mineralization was discovered in 1955 by Texasgulf (Middle River Mining Company) as a result of regional geological mapping followed by airborne electromagnetic and follow-up ground electromagnetic surveys. Bay Copper Mines found the down-dip extension by drilling. Mineral dressing experiments were carried out with limited success. An option agreement was reached between the two companies in 1974. The following year, 7544 m of deep drilling confirmed the continuity of the sulphide body at depth. In 1976 the company considered construction of an 853 m exploration shaft but plans were shelved. An airborne electromagnetic survey flown in 1975 (reported in 1976) indicated no additional targets. In 1979 the Texasgulf property was optioned to Billiton, who drilled a total of 21 336 m in 1980–81. In 1983, Billiton dropped its interest in the property. In 1985, Falconbridge investigated the extent of the gossan on the deposit and its gold–silver content. In 1987–88, deep drilling was carried out by Noranda Exploration Company, Limited and Brunswick Mining and Smelting Corporation Limited. In the fall of 1990, additional diamond-drilling was begun on the property.

GEOLOGY The Halfmile Lake deposit consists of one continuous horizon that is locally repeated by folding and faulting. The known strike length of the Halfmile Lake horizon is approximately 3 km to a depth of 975 m. The three zones (Upper AB, Lower AB, and Main) all contain variable amounts of sphalerite, galena, and chalcopyrite. Stratigraphic evidence indicates the sequence has been overturned, with the stringer zone occurring above the massive sulphides.

RESERVES According to company reports, reserves are: 2 100 000 t grading 6.55% Zn, 2.26% Pb, 0.45% Cu, 37 g/t Ag for the Upper AB Zone; 6 000 000 t grading 10.26% Zn, 3.3% Pb, 0.08% Cu, 28 g/t Ag for the Conwest portion of the deposit; and 1 088 600 t grading 4.63% Zn, 0.87% Pb, 0.46% Cu, 8.9 g/t Ag for the Main Zone.

DEVELOPMENTS A survey to tie in the 1956 Texas Gulf diamond-drilling to the property boundary was completed. Noranda's current drill plan was also completed. The trenches excavated in 1990 were backfilled.

Millican Lake Gold 21 H/4

LOCATION The Millican Lake gold property is located 15 km east of the City of Saint John. It extends from the Cape Spencer deposit northeast to Millican Lake (Figure 14).

COMPANY Mispec Resources Inc., 1643 Loch Lomond Road, Saint John, N.B. E2J 2A2. H.C. McNamara is President.

RIGHTS Mispec Resources Inc. holds 63 claims under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Soil sampling and trenching, carried out mainly in 1985 and 1986, made it possible to trace the gold-bearing zone from the Cape Spencer deposit northeastward to Millican Lake. In 1986, approximately 80 short holes were drilled on the property to delineate the ore zone. Drilling was guided by gold panning results (tills), trenching, and an induced polarization geophysical survey. Under the Mineral Investment Stimulation Programme (MISP), 42 holes were drilled in 1987 and 25 bulk surface samples were collected for analysis. An extension diamond-drilling programme was carried out in 1988. Results of diamond-drilling in the Birches zone of the Cape Spencer claim group were announced by the company in 1989. One drill hole intersected 4.01 g/t Au over 4 m, which included 9.46 g/t Au over 1 m. Another drill hole yielded results of 3.4 g/t Au over 9 m, which included 5.31 g/t over 4 m, 17.90 g/t Au over 1 m, and 13.47 g/t Au over 1 m. Previous drilling in the Road zone, which constitutes the extension of the Gordex Minerals Limited ore zone, intersected 8.50 g/t Au over 5.5 m.

Hecla Mining of Canada Ltd. conducted a detailed induced polarization and basal till geochemical survey on the Mispec Resources property, which the company optioned in 1990. The objective of the investigation is to prepare for an extensive diamond-drilling programme to extend the known ore reserves of the property. Hecla also optioned the Kam Creed Mines Ltd. (formerly Cuvier Mines Inc.) property in this area. Other companies exploring in the Cape Spencer–Black River area include Glenvet Resources Ltd. and Neptune Resources Corp. During the year, Neptune drilled six holes to test some soil anomalies on its property. One hole intersected two consecutive sections assaying 17.4 g/t Au and 0.54 g/t Au.

Geophysical surveys (IP, magnetic susceptibility, gamma-ray spectrometry), soil geochemical surveys, and diamond-drilling were carried out in 1990.

GEOLOGY The area is underlain by Precambrian volcanic and granitoid rocks that are thrust over Carboniferous or older sedimentary rocks. Extensive alteration zones associated with the thrust zone contain pyrite–gold deposits. Illite is the main alteration mineral.

DEVELOPMENTS Acadia Mineral Ventures Limited completed a 13-hole diamond-drilling programme on the property in 1991. The drilling tested new exploration targets defined by geophysical and geochemical surveys conducted in 1990. One hole drilled into the Mitchell's Bog zone assayed 5.84 g/t Au over 1 m. Another hole in this zone intersected two adjacent mineralized sections that assayed 4.60 g/t and 2.83 g/t Au over 1.0 and 0.7 m, respectively.

Mount Pleasant Tungsten, Molybdenum, Indium 21 G/7W

LOCATION The Mount Pleasant property is about 50 km northeast of St. Stephen, Charlotte County (Figure 14).

RIGHTS LAC Minerals Limited holds 4 claims covering the mine area, and LAC Minerals Limited and Billiton Metals Canada Inc. jointly hold 98 claims surrounding the mine area, under the Mining Act, Chapter M-14.1, S.N.B. 1985.

COMPANY The LAC/Billiton tin project is operated by LAC Minerals Ltd. with head offices at 2105 N. Tower, P.O. Box 156, Royal Bank Plaza, Toronto M5J 2J4. Mine Office address is P.O. Box 150, St. George, New Brunswick E0G 2Y0. The President and Chief Executive Officer is P. Allen, the Manager is R. Young.

HISTORY A group called Geochemical Associates staked Mount Pleasant in 1954 for Selco Exploration Ltd. Selco drilled four holes in a geochemical anomaly, but no metallic minerals of interest were intersected and the property was returned to Geochemical Associates.

In 1956, Kennco Exploration (Canada) Limited optioned the property and drilled ten holes, but the results were disappointing and Kennco dropped the option. Mount Pleasant Mines Ltd. staked the ground in 1959. Kennco optioned the property again and drilled several holes that intersected tungsten, molybdenum and tin minerals, but the option was dropped because the mineralized zone could not be followed.

In 1960, a trenching and diamond-drilling programme combined with a detailed geological investigation by the Mount Pleasant Mines geological staff led to the discovery of a tin–base-metal ore zone in the northern part of the property. This ore zone is commonly referred to as the North Zone deposit. Deep drill holes also intersected tungsten–molybdenum ores in the northern part of the property (North Zone) and in the Fire Tower Zone (Mount Pleasant), but lack of sufficient funds prevented systematic drilling of these deeper ore zones. The delineation of the complex geology of the property guided subsequent exploration by Sullico Mines Ltd. This company optioned the property in 1967. Drilling by Sullico and later its wholly-owned subsidiary Brunswick Tin Mines Limited led to the delineation of the tungsten–molybdenum ore zones in the Fire Tower and North zones.

In 1977, Billiton Canada Limited and Brunswick Tin Mines Limited made a joint venture agreement to bring the Fire Tower Zone's tungsten-molybdenum orebody (Fire Tower Zone West) into production. Mill construction and underground work were completed in 1983 when the first concentrates were produced. Commercial production started in 1984. The mine operated until July 31, 1985, when it was forced to close as a result of very poor tungsten and metal prices.

On October 1, 1985, LAC Minerals Limited entered a 50/50 joint venture agreement with Billiton to explore and possibly develop the North Zone tin deposit, located 1 km north of the present mine site. Since October 15, 1985, LAC Minerals has completed 2100 m of underground development to provide drill access to areas of the deposit where additional information was required. To the end of December, 1987, 18 124 m of underground drilling and 3364 m of surface drilling have been completed. Two bulk samples from underground totalling 2652 t were processed at the site and sent for metallurgical analysis.

The feasibility study regarding the mining and processing of tin from the site was completed in late 1987, and was reviewed in 1988. The company did not proceed with development because of low tin prices. During 1988, an evaluation programme was also carried out to explore for other mineral occurrences on the property.

In November of 1989, NovaGold Resources Inc. announced the signing of a letter of intent to acquire the Mount Pleasant tin-tungsten mine from Lac Minerals Limited and Billiton Metals Canada Inc.

NovaGold Resources Inc. drilled three holes in the saddle between the Fire Tower and North zones. These drill holes confirmed the presence of a third major zone on the property. Metallurgical testing of the tin ores is in progress at Lakefield Research, Ontario and at the CANMET Laboratory of the Department of Energy, Mines and Resources in Ottawa.

GEOLOGY "The Mount Pleasant caldera is a north-south trending elliptical feature with minimum dimensions of 13 by 34 km as outlined by regional gravity and magnetic maps...Rocks within the caldera comprise part of the Upper Devonian (previously considered to be Mississippian) Piskahegan Group that is divisible into exocaldera, intracaldera and late caldera-fill sequences." (S.R. McCutcheon, Geological Survey of Canada Open File 2157)

"...the Mount Pleasant deposits are associated with hydrothermal breccias and intrusive rocks that cut the intracaldera sequence...The intracaldera rocks have been highly brecciated, altered and mineralized in two areas at Mount Pleasant designated the North Zone and the Fire Tower Zone. In both areas, crosscutting breccias and associated intrusive rocks form irregular, roughly vertical, pipelike complexes that were centres of subvolcanic intrusive and related hydrothermal activity. Smaller intrusive centres with little or no surface expression occur in the Saddle Zone between the North Zone and the Fire Tower Zone and at Hornet Hill." (W.D. Sinclair and G.J.A. Kooiman, Geological Survey of Canada Open File 2157)

RESERVES (Published) Reserves for the Fire Tower Zone are 12 220 000 t of ore grading 0.38% WO_3 and 0.2% MoS_2. The North Zone reserves are 5 600 000 t grading 0.79% Sn.

PRODUCTION There has been no production since 1985 and none is planned.

EMPLOYEES During 1991, security staff were on site.

DEVELOPMENTS Gradually improving tin prices and a rapid increase in demand for indium and bismuth have revived interest in the Mount Pleasant deposit and in tin prospects to the west of the deposit. The discovery of high-grade tin float (two samples assaying 20.3% and 21.0% Sn) at True Hill, 4 km west of Mount Pleasant, initiated new staking in that area. In the Pleasant Ridge area, 1 km west of True Hill, K.D.A. Whaley sampled three trenches across a tin–zinc-bearing vein system that intersected: (1) 0.7 m assaying 15.5% Zn and 0.98% Sn; 1.8 m assaying 9.02% Zn and 0.98% Sn, and 2.0 m assaying 1.5% Zn and 1.35% Sn; (2) 2.7 m assaying 6.25% Zn and 1.04% Sn; (3) 1.5 m assaying 9.21% Zn and 0.59% Sn, and 1.1 m assaying 8.21% Zn and 0.78% Sn. No indium assays are available for this prospect.

The discovery of the high-grade Saddle zone will undoubtedly increase the tin reserves. It has also been estimated that Mount Pleasant contains about 25% of the world's known reserves of indium.

Nash Creek Zinc, Lead, Silver — 21 O/16E

LOCATION The Nash Creek deposit is approximately 48 km northwest of Bathurst (Figure 14).

COMPANY Falconbridge Limited, whose head office address is: P.O. Box 40, 40th Floor, Commerce Court W, Toronto, Ontario M5L 1B4. Telephone: (416) 863-7000.

RIGHTS Falconbridge Limited holds 225 claims under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY Three areas of mineralization have been found so far over a strike length of about 2 km. The most northerly area, near MacMillan Brook, was discovered in the 1950s and was investigated by Dome Mines Limited in 1962. The best intersection reported by Dome was 9.85% combined Pb–Zn over approximately 6 m. In the late 1970s Texasgulf discovered another area to the southeast of, and stratigraphically lower than, the MacMillan Brook one. The best intersection reported was 12.61% combined Pb–Zn over 2.3 m. In 1988–1989, Falconbridge Limited discovered a third area, the most southerly one to date, in the vicinity of Hayes Brook. The Hayes Brook zone contains 940 000 t of ore (probable reserves) grading 4.58% Zn, 0.85% Pb, and 26.23 g/t Ag plus 1 340 000 t of ore (possible reserves) grading 4.75% Zn, 0.89% Pb, and 27.94 g/t Ag.

GEOLOGY The property is underlain by shallow marine volcanic and sedimentary rocks of the Lower Devonian Dalhousie Group. The base metals are largely stratabound, within autobrecciated lavas and hyaloclastites that strike north-south and dip moderately to steeply west.

DEVELOPMENTS In 1991, 1500 m of diamond-drilling was completed.

Restigouche Zinc, Lead, Silver, Copper 21 O/7, 10

LOCATION The Restigouche zinc, lead, silver, copper deposit is located on the Road to Resources, about 70 km west of Bathurst in Restigouche County (Figure 14). (Lat. 47°30.2′N; Long. 66°33.5′W)

COMPANY Marshall Minerals Corp. The head office is 4776 Bridge St., P.O. Box 356, Niagara Falls, Ontario L2E 6T8. The Chairman and CEO is H.G. Quint and the President is G.H. Hedican. Telephone: (416) 356-9112.

RIGHTS In 1991, Marshall Minerals Corp. held a block of 273 claims under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY The property was initially staked by Selco in 1954 because of strong base-metal anomalies in streams draining the area. In 1957, the property was optioned to New Jersey Zinc Company who discovered the sulphide deposit by drilling a strong soil geochemical anomaly. Teck Corporation (Keevil Mining Group) optioned the property in 1965. After several drill holes and metallurgical tests, Teck dropped its option in 1970. In 1972, the property was optioned to Gowganda Silver Mines who turned over its interest to Placer Development in 1974. In 1980, Placer optioned this deposit to Billiton who completed 11 278 m of drilling and then dropped it in 1983. Extensive geological, geophysical, and geochemical studies were carried out and the extensive drilling added 90 720 t to the ore reserves. In 1985, Lincoln Resources optioned the property. The property was optioned by Southwind Resources in 1986. Marshall Minerals acquired the rights to the property from Placer Dome Inc. in March of 1988.

After acquiring the mineral rights to the Restigouche deposit, Marshall Minerals embarked on an extensive drilling programme to further define reserves and processibility of the ore. Results proved favourable and in February of 1989 Marshall registered under the Province's Environmental Impact Assessment Regulation. The project was subsequently screened in because the deposit is situated on Charlotte Brook, which flows into Upsalquitch Lake, a well-known sport fishing area in a relatively undisturbed part of the Province. The company completed its Environmental Impact Assessment report for the project and in August of 1990 received a positive response from the Lieutenant-Governor in Council to proceed in the development of the project. A security of $1 600 000 will be required to ensure the environmental integrity of the operation.

Because the deposit is not large enough to support a mill, the company had hoped to enter into an agreement with a local mill to process the Restigouche ore. The cost of bringing the property into production is expected to be in the range of $3 000 000. Production is expected to be about 1500 t/d from an open pit operation employing 50 people for a period of 4 years. Marshall has proceeded no further than the EIA approval in its acquisition of required government approvals. Delay associated with the EIA process, the sharp downturn in zinc prices, and the closure of the Caribou operation motivated the company to put the deposit up for sale and concentrate more effort on the development of properties outside the Province.

GEOLOGY The host rock is Ordovician sericite–chlorite and chlorite–sericite schist that overlies interbedded metaquartzite and metagreywacke. Conformable lenses of banded, massive to disseminated, fine-grained pyrite–sphalerite–galena–chalcopyrite–minor tetrahedrite plunge approximately 17° to the north-northwest. This zone is 490 m long and averages 90 m wide and 30 m thick. Mineralization outcrops to the south and has been traced to a vertical depth of 183 m to the north. Minor folds are common, and the host rock is chloritized adjacent to the mineralization.

RESERVES Marshall Minerals Corp. reported total reserves of 1 730 000 t grading 0.35% Cu, 5.36% Pb, 6.94% Zn, 112.1 g/t Ag, and 1.2 g/t Au. This includes 1 150 000 t of open pit reserves grading 0.38% Cu, 5.96% Pb, 7.71% Zn, 124.1 g/t Ag, and 1.37 g/t Au using a 6% combined lead–zinc cutoff.

DEVELOPMENTS No activities took place during 1991.

Sewell Brook Zinc, Lead, Copper, Silver 21 0/3E

LOCATION The Sewell Brook property is 25 km northeast of the village of Plaster Rock, Victoria County, New Brunswick (Figure 14).

COMPANY NovaGold Resources Inc. The head office address is: 2nd Floor, 1583 Hollis St., Halifax, Nova Scotia B3J 1V4. Telephone: (902) 420-0230.

RIGHTS NovaGold Resources Inc. holds approximately 350 contiguous claims under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY A geological mapping project carried out by Reginald Wilson of the Geological Surveys Branch resulted in the identification of four mineralized areas. One of these was the Sewell Brook area, where a previously unknown base-metal occurrence along a new logging road yielded a grab sample that assayed 0.06% Cu, 1.3% Pb and 0.89% Zn.

In 1989, soil sampling, VLF EM and magnetometer surveys were carried out in proximity to the discovery showing, followed by gradient IP to help define a target.

A chargeability anomaly within a broad resistivity low was tested by diamond-drilling in 1990. The first hole cut three sulphide zones: 1.54 m of 9.06% combined Pb–Zn, 1.85 m of 12.00% combined Pb–Zn, and 10.15 m of 3.72% Cu, all within 50 m of surface. Subsequent exploration drilling included intersections of 5.72 m of 40.97% Pb+Zn, and 5.03 m of 36.09% combined Pb–Zn.

GEOLOGY Sewell Brook is a Kuroko-type volcanogenic massive sulphide deposit that is associated with submarine rhyolite flows of the Lower Devonian Tobique Group. Massive sulphides occur in at least two stratigraphic positions within the sedimentary–volcanic sequence.

DEVELOPMENTS A 25-hole definition drilling programme, on 10 m centres, was completed by March of 1991 (Table 3). Results showed that the deposit is a classic Kuroko-type; one zone contains approximately 25 000 t grading 20% combined lead–zinc. In May, NovaGold and Kennecott Canada Inc. entered into a joint venture agreement that included the Sewell Brook and Sears Lake properties. NovaGold continues as the operator. Subsequently, 320 line-kilometres of grid was established over the 182-claim Sewell Brook group to permit detailed mapping, prospecting, and geophysical surveys of the gound outside the discovery zone. Drill targets were tested in November of 1991.

TABLE 3. DRILL-HOLE INTERSECTIONS, SEWELL BROOK DEPOSIT

DDH No.	Length (m)	Cu (%)	Pb (%)	Zn (%)	Ag (g/t)	Au (g/t)
91-08-2d	2.30	0.35	7.63	12.40	121.45	1.60
	3.81	0.12	1.50	4.01	21.21	0.27
	1.01	0.10	2.07	5.68	12.67	0.03
91-08-3d	2.59	2.24	3.39	20.50	45.79	0.58
	1.70	0.09	4.96	10.06	39.04	0.38
	2.74	0.12	0.22	4.80	19.25	0.70
91-08-4d	9.95	0.47	4.25	20.60	82.98	0.69
91-08-5d	9.88	0.34	2.99	8.06	66.99	0.51
	2.15	0.01	1.02	2.80	14.91	0.11
	2.15	0.03	1.90	3.84	25.21	0.24
	1.04	0.02	0.98	1.86	53.77	0.31
91-08-6d	2.85	0.34	5.17	17.05	74.72	0.93
91-08-8d	11.55	0.50	3.07	14.85	62.82	0.73
91-08-9d	4.70	0.12	3.60	7.32	72.12	0.77
91-08-10d	9.78	1.04	4.58	28.08	52.39	0.69
91-08-17d	4.78	0.49	4.73	21.34	56.19	0.48
91-08-18d	3.58	0.45	5.37	23.42	42.14	0.65
91-08-20d	9.35	1.40	2.26	14.50	31.18	0.50

NONMETALLIC MINERALS

INDUSTRIAL ROCKS AND MINERALS

In 1991, industrial rock and mineral activity was centred around aggregate, potash, lime and limestone, dimension stone, clay/shale, and cement.

Considerable interest has been expressed in the strategic location and development of suitable sources of high-specification bedrock aggregate in the Province. Plans to upgrade the Province's highway system, the Trans-Canada Highway and its arterial roads in particular, are expected to bring about major expansion of some producing quarries and the establishment of new, strategically located enterprises. The potential for export to the northeastern United States remains a lucrative possibility.

New or expanded operations are expected to enter the aggregate supply picture in the near future. One located is in the southern part of the Province at the Port of Bayside. L.E. Shaw Limited has entered into an agreement with the Department of Economic Development and Tourism to develop a tidewater quarry site for aggregate export.

A new Potash Exploration Policy announced in 1990 has utilized concepts extracted and modified from the Province's Mining Act and the Oil and Natural Gas Act. Essentially, an individual(s) or company(ies) may now apply for an exploration agreement to search for potash and related minerals in an area of their choice provided certain terms and conditions are fulfilled.

BP Resources Canada Ltd. (Mining Division) has not announced any plans to proceed further with development of its Millstream potash property, 10 km west of Sussex.

The installation of a flue-gas desulphurization wet limestone scrubbing system at the coal-fired Belledune power-generating station has sparked a flurry of activity pertaining to the evaluation of the Province's limestone resources. The capture of SO_2 utilizing wet limestone slurry (i.e., scrubber) technology requires high-grade limestone to act as sulphur-capture medium. The power utility has estimated that the annual consumption will be up to 150 000 t of limestone/450 MW unit over a 30-year period. The limestone quality must be 90% $CaCO_3$ or better.

In the fall of 1991 NB Power selected Elmtree Resources Ltd. to supply limestone to the Belledune generating station. Commencing in 1993, the station will require about 100 000 t/a for use in its acid gas scrubber.

There has been a modest revival of interest in the Province's dimension stone, primarily in the fields of restoration and related renovation to buildings, bridges and the like. One of several sandstone quarries in the Fort Folly Point area south of Moncton was reactivated in 1989 and continued to operate on a demand basis. Dimension stone exploration was reported from northern New Brunswick and north of the Village of St. George in Charlotte County.

PEAT

Nine applications for a Peat Exploration Licence were under review in 1991. Three licences were issued: 91-1 to La Cie de Tourbe Fafard Ltée for Bog 552; 91-2 to La Mousse Acadienne (1979) Ltée for Bogs 301 and 302A; 91-3 to Entreprises Premier CDN Ltée for Bog 16. The peat exploration licence application by Le Groupe Qualité Lamèque Ltée for Bog 25 was dropped in favour of an Option. Other applications received were from: Lafaille Peat Moss Inc. (Bog 324N); Beausejour Peat Moss Inc. (Bogs 61 and 76); and Berger Mix Inc. (Bogs 305 and 324N).

Peat Exploration Licence 88-2 held by Entreprises Premier CDN Ltée for Bog 389 expired and was replaced by an Option.

Acadian Peat Moss (1979) Ltd.

COMPANY Acadian Peat Moss (1979) Ltd., P.O. Box 240, Lamèque, N.B. E0B 1V0. The President is Elphège Chiasson. Telephone (506) 344-2225.

RIGHTS Peat Exploration Licence 91-2 (1073 ha) on Bogs 301 and 301A, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bogs 301 and 301A are located 8 km southwest of Eel River Bridge, off Highway 117 (Figure 14).

HISTORY Acadian Peat Moss (1979) Ltd. applied for a Peat Exploration Licence in 1989. A licence was issued in 1991.

RESERVES AND GRADE 15.23 Mm^3 surficial peat and 1.61 Mm^3 humified peat on a total bog area as follows:

Bogs 301 and 301A	Total Bog (ha)	> 1 m (ha)
Crown	1073	610
Freehold	11	0
Total	1084	610

Entreprises Premier CDN Ltée

COMPANY Entreprises Premier CDN Ltée, 454 Chemin Témiscouata, C.P. 2600, Rivière-du-Loup, Québec G5R 4C9. The contact person is Claude Samson. Telephone: (418) 862-6356.

RIGHTS Peat Exploration Licence 91-3 (426 ha) on Bog 16, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 16 is located on Highway 126, 3 km south of Rogersville (Figure 14).

HISTORY Entreprises Premier CDN Ltée applied for a Peat Exploration Licence in 1991. A licence was issued in that same year.

RESERVES AND GRADE 6.15 Mm^3 surficial peat and 2.53 Mm^3 humified peat on a total bog area as follows:

Bog 389	Total Bog (ha)	>1 m (ha)
Crown	426	271
Freehold	33	12
Total	459	283

Fafard Peat Moss Co. Ltd.

COMPANY Fafard Peat Moss Co. Ltd., P.O. Box 70, Shippagan, Gloucester County, New Brunswick. Telephone (506) 336-9715. The Manager is René Martin.

RIGHTS Peat Exploration Licence 88-1 (410 ha) on Bog 552, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 552 is located 6 km southwest of Black Rock. Access is by dirt road off Highway 635 (Figure 14).

HISTORY Fafard Peat Moss Co. Ltd. applied for and received a Peat Exploration Licence in 1988. Exploration work was conducted in 1988 and 1989. A new licence was issued in 1991.

RESERVES AND GRADE 9.78 Mm^3 surficial peat and 5.13 Mm^3 humified peat on a total bog area as follows:

Bog 552	Total Bog (ha)	>1 m (ha)
Crown	410	353
Freehold	0	0
Total	410	353

ENERGY RESOURCES

OIL SHALE

Emery Associates 21H/15E

COMPANY Emery Associates, Box 219, Purdy Road, Colborne, Ontario K0K 1S0.

RIGHTS Bituminous Shale Licence to Search 90-1 was issued to Emery in May, 1990. The licence comprises 8998 ha and is issued under the Bituminous Shale Act, Chapter B-4.1, R.S.N.B. 1976.

LOCATION Licence to Search 90-1 occupies an approximately rectangular area in Westmorland County between the Petitcodiac and the Memramcook rivers. The area includes the villages of Belliveau, Dover, Memramcook, Saint-Joseph, and Taylor Village (Figure 14).

HISTORY Oil shales have been known in the Westmorland County area for more than 100 years. In 1942 the Canada Department of Mines and Resources drilled seven core holes at Taylor Village totalling 320 m. In 1967 and 1968 the Atlantic Richfield Company drilled five exploratory oil shale holes in the Dover, Saint-Joseph, and Taylor Village areas.

The area was held under a Bituminous Shale Licence to Search by Canadian Occidental Petroleum from 1974 to 1981. The company carried out an oil shale mapping survey and reported assay work on numerous surface samples.

Petro-Canada held a Bituminous Shale Licence to Search in the Westmorland County area from 1981 to 1984. They drilled 963 m of core in three holes in the Dover and Boudreau Village areas.

In 1985 to 1989, Cartago Resources Ltd. of Vancouver, British Columbia held a Bituminous Shale Licence to Search encompassing the same area as that of Emery's licence 90-1. During Cartago's tenure, a shallow (106 m) hole was sunk and a trench was excavated in a prospective oil shale bed.

EXPLORATION During 1990 the company opened three trenches in the vicinity of the previously excavated Cartago trench. Shales from the trenches were channel sampled and analyzed for calcium, magnesium, and oil yield. Results submitted in 1991 outlined a high-grade oil shale bed. No exploration was undertaken in 1991; in July the Licence to Search was cancelled as a result of the licensees inability to raise exploration capital. The trenches opened in 1990 were refilled and reclaimed to the property owner's satisfaction.

OIL AND NATURAL GAS

Pembina Resources Limited 21 H/15

COMPANY Pembina Resources Limited, P.O. Box 1948, 734–7th Avenue S.W., Calgary, Alberta T2P 2M7.

RIGHTS ONG lse/on-sh 88-1, 88-2, and 88-3 (11 134.8 ha) under the Oil and Natural Gas Act, Chapter O-2.1 R.S.N.B. 1976

LOCATION ONG lse/on-sh 88-1 to 88-3 inclusive are located approximately 15 km south and southeast of Moncton (Figure 14).

HISTORY Effective January 1, 1989, Pembina Resources Limited and Western Decalta Petroleum (1977) Limited amalgamated, retaining the above company name and address. All three leases are in their fifth year of a ten-year term.

OUTLOOK All three leases are in good standing.

J.A. Seglund Inc. 21 H/15

COMPANY J.A. Seglund Inc., 4720 Southshore Drive, Metaire, Louisiana, U.S.A. 70002

RIGHTS ONG lic/on-sh 91-01 (10 058.3 ha) under the Oil and Natural Gas Act, Chapter O-2.1 R.S.N.B. 1976

LOCATION This 28 section licence to search is located about 15 km south of Moncton on the west side (Albert County) and east side (Westmorland County) of the Petitcodiac River (Figure 14).

HISTORY Licence to Search 91-01 was granted on March 4, 1991. The Westmorland County part of the licence area contains the old Saint-Joseph oil field, which was discovered in several shallow drill holes between 1890 and 1905.

OUTLOOK The licence to search is in good standing.

CHAPTER 3.
MINE DEVELOPMENT IN NEW BRUNSWICK

METALLIC MINERALS

Stratabound Minerals Corp. (CNE Deposit) 21 P/5W

LOCATION The Captain North Extension (CNE) zinc, lead, silver deposit is 14 km east of the Heath Steele mine, just east of the Northumberland–Gloucester county line and about 1.5 km north-northwest of the Captain deposit (Figure 15). (Lat. 47°17.7′ and Long. 65°53.2′) It is accessible via Highway 430 and secondary roads.

COMPANY Stratabound Minerals Corp. The head office is: Suite 518, Touchstone Place, 222–58th Ave. SW, Calgary, Alberta T2H 2S3. Telephone: (403) 258-3630. Mr. S.J. Stricker is President and Mr. K.D.A. Whaley is Vice-President in charge of exploration.

RIGHTS Stratabound Minerals Corp. holds Mining Lease 251 under the Mining Act, Chapter M-14.1, S.N.B. 1985.

HISTORY The CNE deposit was found by Sabina Industries in 1978 as a result of stream-silt and soil (organic) geochemical surveys. Sixteen holes were drilled but only two intersected significant lead–zinc mineralization. The property was dropped in 1983 and acquired by Billiton but they did no further drilling. In 1986 the property was staked by N. Pitre who optioned it to Noranda Exploration Company, Limited the following year. After drilling nine holes in 1987 and two in 1988, Noranda concluded that the CNE deposit was too small to warrant further investigation and returned the property to Norman Pitre in October of 1988.

Drilling and trenching programmes carried out in 1988–89 indicated a high grade, low tonnage, zinc–lead–copper–silver deposit very close to surface (6 m). Initial bench-scale metallurgical tests indicate high recoveries and acceptable grade concentrates. Based on these results Stratabound registered the project under the Environmental Impact Assessment Regulation and the project was subsequently screened out with conditions.

Following the positive Environmental Impact Assessment screening decision, Stratabound Minerals Corp. applied to the Department of Natural Resources and Energy to remove a 11 100 t bulk sample to test the metallurgy of the ore. The bulk sample was removed in September and milled at the nearby Heath Steele Mines facility with successful results.

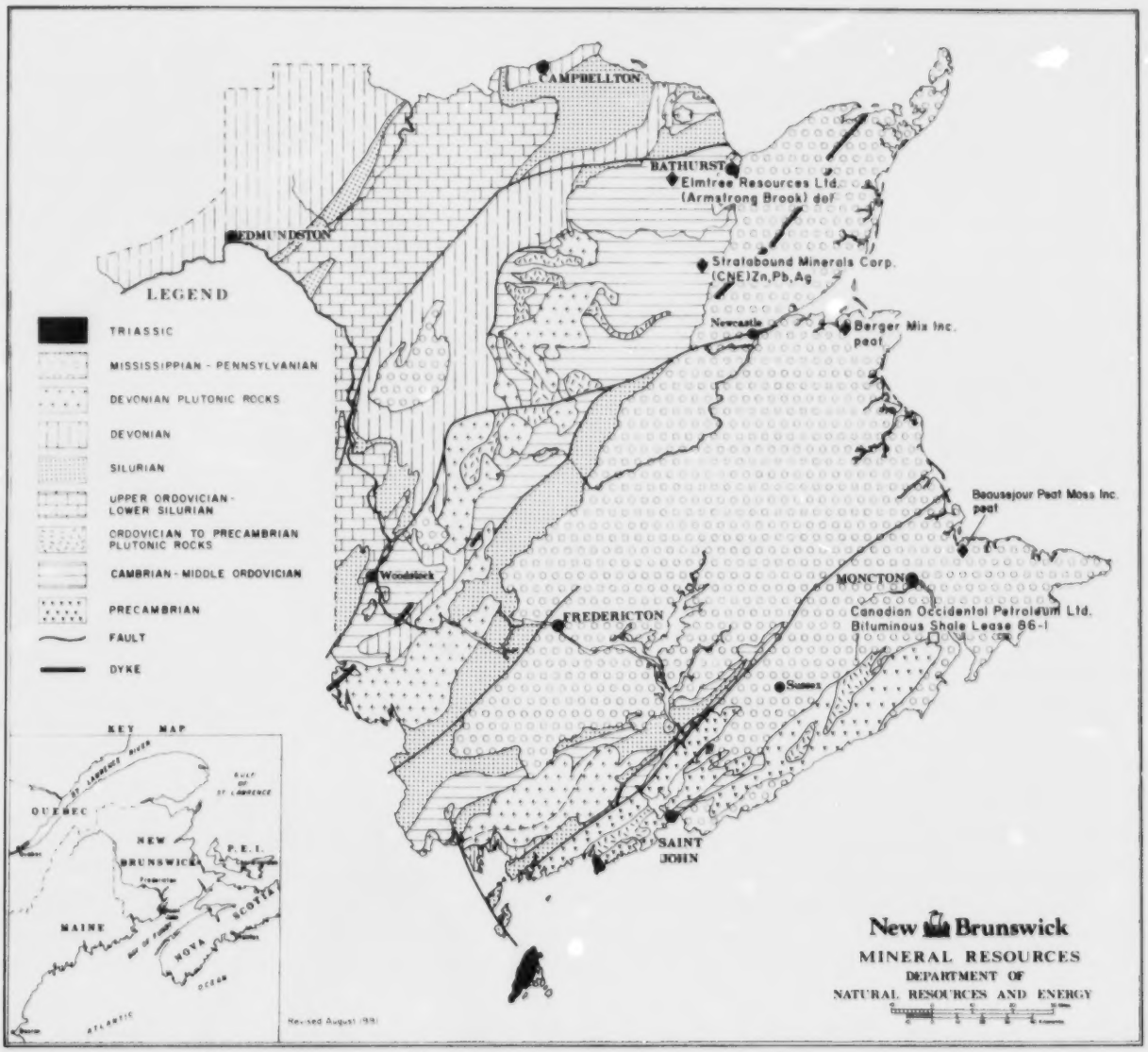


Figure 15. Mine properties in development stage in New Brunswick in 1991.

GEOLOGY The CNE deposit is situated within a northerly trending sequence of sedimentary and felsic volcanic rocks that comprise part of the Ordovician Tetagouche Group. Lithologically, these rocks are very similar to those in the vicinity of the Brunswick massive sulphide deposits, i.e., siltstones, quartz augen schists, quartz-feldspar augen schists, and massive rhyolites.

According to Whaley (Stratabound Minerals Corp. Annual Report for 1989), the massive sulphides occur in five lenses at surface. The lenses have a northerly strike and a vertical to west 70° dip. The proven reserves are in lenses 2 and 3. The sulphides are coarse grained and composed dominantly of sphalerite, pyrite, and galena with minor arsenopyrite and trace amounts of chalcopyrite, cassiterite, and argentiferous tetrahedrite.

RESERVES Drill-indicated geological reserves, using a cut-off grade of 8% combined lead-zinc, are 208 000 t grading 7.38% Zn, 2.76% Pb, and 91.78 g/t Ag (Stratabound Minerals Corp. Annual Report for 1989). Of the calculated reserves, 91.8% is probable and 8.2% is possible.

EMPLOYEES Contract workers carried out each mining campaign.

DEVELOPMENTS Following the successful milling of the company's bulk sample at Heath Steele Mines in September of 1990, Stratabound Minerals Corp. proceeded with a feasibility study to confirm the economic viability of the CNE deposit. At the same time, the mine approval process was started and discussions were held with Heath Steele concerning a potential contract for any future production from the CNE property. Work proceeded on preparing the deposit for production and was ready in August. A successful agreement was arrived at with Heath Steele for the sale of the ore and the company received its Mining Lease and other required permits during the same period. Mining in 1991 was done by a local contractor during two campaigns with approximately 15 000 tons mined in September and December for shipment to Heath Steele from the CNE north pit. The mining life of the deposit will depend on the Heath Steele mill's production schedule and capacity requirements for processing the ore and any future extension of reserves at the CNE site. The pit contains a reserve of 228 812 t averaging 7.38% Zn, 2.76% Pb, and 91.9 g/t Ag, based on a cutoff grade of 8% combined Pb-Zn.

Stratabound has entered into an exploration/joint venture agreement with Teck Corporation that will include the following Stratabound properties in New Brunswick: Taylor Brook, Stratmat West, Stratmat North, and the CNE property (except the CNE open pit). In return for the right to earn 51% interest in these properties, Teck has agreed to spend $3 000 000 on exploration over four years and pay Stratabound $50 000 upon signing. Teck will also purchase $87 500 worth of Stratabound shares on each of the three anniversary dates after the deal is signed and $200 000 on the fourth anniversary. In exercising this option, there is a minimum progressive price ($2.00, $2.25, $2.50, and

$2.75, respectively, on each of the anniversary dates) that Teck must pay for each share or the current market price, whichever is greater. Teck must also spend a minimum of $300 000 in the first year of the agreement and $250 000 in each subsequent year. The total of $3 000 000 must be spent by the end of the agreement or the properties revert back to Stratabound with no compensation to Teck.

NONMETALLIC MINERALS

PEAT

Two peat moss operations were in a development stage in 1991: Berger Mix Inc. (Bog 354) and Beausejour Peat Moss Inc. (Bog 76).

Beausejour Peat Moss Inc.

LOCATION Bog 76 is located 5 km southeast of Shediac and about 3 km south of Highway 15, Westmorland County (Figure 15).

COMPANY Beausejour Peat Moss Inc., R.R. #1, P.O. Box 58, Shediac, New Brunswick EOA 3G0. The President is Paul-Émile Leger. Telephone: (506) 532-1172.

RIGHTS The company has acquired rights to freehold lands on Bog 76.

HISTORY In 1991, Beausejour Peat Moss Inc. applied for a Peat Exploration Licence for portions of Bog 76 held by the Crown. During the same year, the company acquired freehold land in the northeastern sector of Bog 76.

RESERVES AND GRADE 6.97 Mm^3 surficial peat and 4.19 Mm^3 of humified peat on a total bog area as follows:

Bog 76	Total Bog (ha)	> 1 m (ha)
Crown	218	177
Freehold	187	112
Total	405	289

DEVELOPMENT The company built an access road and began site preparation and ditching on its land holdings.

Berger Mix Inc.

LOCATION Bog 354 is located 35 km southwest of Bay du Vin (Figure 15). Access is by the Rosaireville road.

COMPANY Berger Mix Inc., 121, R.R. #1, St-Modeste, Québec GOL 3WO. The contact person is Yves Gauthier. Telephone: (418) 862-4462.

RIGHTS Peat Moss Lease No. 33 (159 ha) on Bog 354, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

HISTORY Berger Mix Inc. applied for and received a Peat Exploration Licence in 1988. The project was screened out under the Environmental Impact Assessment Regulation in 1989. A Peat Lease was issued in 1991.

RESERVES AND GRADE 10.29 Mm^3 surficial peat and 1.82 Mm^3 humified peat on a total bog area as follows:

Bog 354	Total Bog (ha)	> 1 m (ha)
Crown	186	146
Freehold	286	151
Total	472	297

DEVELOPMENT The company built an access road and continued site preparation and ditching on its land holdings.

DOLOMITE

Elmtree Resources Ltd. (Armstrong Brook) 21 P/12W

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas, and the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Quarry Lease 26 (59.10 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968, and Mining Lease 247 (161.1 ha) under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This dolomite deposit is located about 22 km west of Bathurst, Gloucester County (Figure 15).

HISTORY The deposit was found several years, perhaps decades, ago. It appears to have been used by local farmers, since the ruins of old kilns are present in the area. The deposit was rediscovered by Anaconda geologists in the 1950s while exploring for sulphide deposits. It was briefly investigated by J.W. McCarthy in the early 1970s and staked by Elmtree Resources Ltd. in 1982. An access road was constructed in 1983 and limited production for testing purposes was undertaken.

RESERVES AND GRADE Exploration and development work by Elmtree Resources Ltd. has resulted in the delineation of more than 2 000 000 t of dolomite grading up to 37% $MgCO_3$.

PRODUCTION None.

DEVELOPMENT Plans to install additional crushing equipment for production of dolomitic ag lime and construction stone have been delayed.

EMPLOYEES Manpower was provided by staff of Elmtree Resources Ltd.

ENERGY RESOURCES

OIL SHALE

Canadian Occidental Petroleum Limited 21 H/15E

COMPANY Canadian Occidental Petroleum Limited, 1500, 635-8th Avenue S.W., Calgary, Alberta T2P 3Z1. Telephone: (403) 234-6700. The President is J. Angus McKee and the General Manager (oil shales) is E. Yildirim.

RIGHTS Canadian Occidental Petroleum Limited, a public company with 48% ownership by Occidental Petroleum Limited and 52% by shareholders, retains Bituminous Shale Lease 86-1 (1439 ha) under the Bituminous Shale Act, Chapter B-4.1, R.S.N.B. 1976.

LOCATION The lease area lies in the Albert Mines area about 25 km south-southeast of Moncton in Albert County (Figure 15).

HISTORY Bituminous shale was first reported at Albert Mines by Dr. Abraham Gesner in 1841. The area is best known for the solid hydrocarbon (albertite) vein that was discovered there by John Duffy in 1849. The vein was mined out between 1852 and 1880.

The importance of the oil shales first gained attention between 1854 and 1856 when Dr. Gesner retorted a burning oil from them. Following the closure of the albertite mine in 1880, the area attracted little detailed interest until 1942 when the Canada Department of Mines drilled 36 shallow core holes near the old mine. In 1968, the Atlantic Richfield Company Limited drilled two holes at Albert Mines. One of these holes assayed 63 litres of shale oil per tonne over 130 m.

RESERVES AND GRADES In 1942, the Canada Department of Mines estimated that there were 90 900 000 t of oil shale averaging 44 L/t, yielding about 47 700 m^3 (300,000 barrels) of shale oil to a depth of 120 m. In 1982, the Geological Survey of Canada and the New Brunswick Department of Natural Resources estimated that there were about 42 925 000 m^3 (270,000,000 barrels) of oil in situ to a depth of 600 m.

EXPLORATION In 1974, Canadian Occidental Petroleum Limited acquired the rights to the Albert Mines area by means of a Bituminous Shale Licence to Search covering 404 700 ha in southeastern New Brunswick. They converted this licence in 1981 to a development permit of about 29 138 ha. Between 1974 and 1981 nine core holes were drilled and a high-grade oil shale zone was partially delineated. In 1983, the permit area was reduced to 1439 ha. In 1986, the development permit was converted to a Bituminous Shale Lease.

In 1986, Canadian Occidental completed a resource evaluation study that began in 1984. This evaluation provided the basis for a mine evaluation plan for the Albert Mines site. A general plan for large-scale mining and a plan for excavating 40 000 to 50 000 t of shale from a small test pit have been submitted. The test pit sample was provided to the New Brunswick Electric Power Commission to run in its Chatham circulating fluidized-bed (CFB) cocombustion demonstration plant in 1986.

In the past, Canadian Occidental has provided several tonnes of oil shale to Umatac Industrial Processes of Alberta, Lurgi GmbH of Germany, Petroleo Brasileiro S.A. of Brazil and the New Brunswick Electric Power Commission. The samples provide data on retorting and fluidized-bed combustion characteristics of Albert Mines oil shale.

No activity was recorded for the lease area during 1990. The preliminary economic analyses of commercial-scale oil shale/coal circulating fluidized bed (CFB) combustors and a stand-alone oil shale retort that were initiated in 1989 were continued.

DEVELOPMENTS No production activity was recorded on the lease area during 1991. A cost-shared study between Canadian Occidental Petroleum and the Province of New Brunswick (funded under the Canada–New Brunswick Cooperation Agreement on Mineral Development) on the preliminary economics of commercial-scale retorting and circulating fluidized-bed combustion was completed. A 1 t bulk sample from the lease was provided to BBC Engineering of Markham, Ontario. BBC ran the sample through its newly designed demonstration-scale ablative fast pyrolysis reactor that gave very high oil yields, up to 140% of conventional Fischer Assay results.

CHAPTER 4.
PRODUCING MINES AND QUARRIES IN NEW BRUNSWICK

VALUE OF PRODUCTION

The preliminary estimate of New Brunswick's mineral production for 1991 is $617 007 529 (Tables 4 and 5), which represents a 29.7% decline from the 1990 final value of $877 926 043. This significant decline in value is attributed to lower metal prices and the extended strike at the mine and smelter of Brunswick Mining and Smelting Corporation Limited (BM&S).

The total value of metals produced was $325 545 700, representing 52.8% of the total production value. Zinc continues to contribute the largest amount, $212 528 512, to this figure even though this figure is 53% lower than the previous year's. This decrease was mainly the result of the strike at BM&S and a general decline in zinc prices, which ranged from a high of 65.1 US¢/lb. to a low of 44.1 US¢/lb. Lead continued to be the second most valuable contributor to the metal sector at $50 224 782; however, it too was down 25% over the previous year, again because of low prices. The value of copper was approximately the same ($27 534 795) as the 1990 figure even though the price declined over the year. Antimony, bismuth, and cadmium continued to be produced at BM&S as a byproduct of its operation. Bismuth had a value of $975 000 representing a 48% increase over 1990 and the value of cadmium production dropped 15% to $235 329.

TABLE 4. MINERAL PRODUCTION IN NEW BRUNSWICK, 1981 TO 1991
(compiled from Energy, Mines and Resources statistics)

Calendar Year	Metals ($)	Nonmetals ($)	Fuels ($)	Structural Materials ($)	Total ($)
1981	452 580 000	16 666 976	23 325 535	39 769 000	532 341 511
1982	409 832 000	20 587 126	24 630 614	43 241 000	498 290 740
1983	421 281 000	19 220 800	29 707 000	38 385 000	508 593 800
1984	497 981 000	47 973 438	29 837 000	42 178 000	617 969 438
1985	364 825 000	62 025 000	31 025 000	43 727 000	502 203 000
1986	312 466 000	118 813 000	28 027 000	42 264 000	501 570 000
1987	391 836 000	152 481 000	33 347 000	44 567 000	622 231 000
1988	604 045 000	226 908 000	33 530 000	46 319 000	910 802 000
1989	582 439 000	210 998 000	33 740 000	45 896 000	864 073 000
1990	584 491 926	208 784 840	37 200 000	47 449 277	877 926 043
1991(P)	325 545 700	212 321 987	34 200 000	44 939 842	617 007 529

P preliminary

TABLE 5. MINERAL PRODUCTION IN NEW BRUNSWICK, 1991
(Compiled from Energy, Mines and Resources statistics)

Preliminary Estimate

Commodity	Units	Quantity	Value ($)
Metals			
Antimony	kg	---	---
Bismuth	kg	130 000	975 000
Cadmium	kg	47 000	235 329
Copper	kg	10 138 182	27 534 795
Gold	g	---	---
Lead	kg	59 018 545	50 224 782
Silver	kg	153 057	22 869 012
Zinc	kg	169 886 900	212 528 512
TOTAL			325 545 700
Nonmetals			
Marl	t	---	---
Peat	t	280 056	26 934 202
Potash	t	---	---
Salt	t	---	---
Sulphur (in smelter gas)	t	46 960	6 546 507
TOTAL			212 321 987
Fuels			
Coal	t	500 000	34 200 000
Natural Gas	m^3	---	---
TOTAL			34 200 000
Structural Materials			
Lime	t	---	---
Sand and Gravel (including silica)	t	6 842 540	14 386 675
Stone	t	2 769 713	18 397 674
TOTAL			44 939 842
GRAND TOTAL 1991 (CDN $), preliminary			617 007 529

GRAND TOTAL 1990 (CDN $) $877 926 043

GRAND TOTAL 1989 (CDN $) $864 073 000

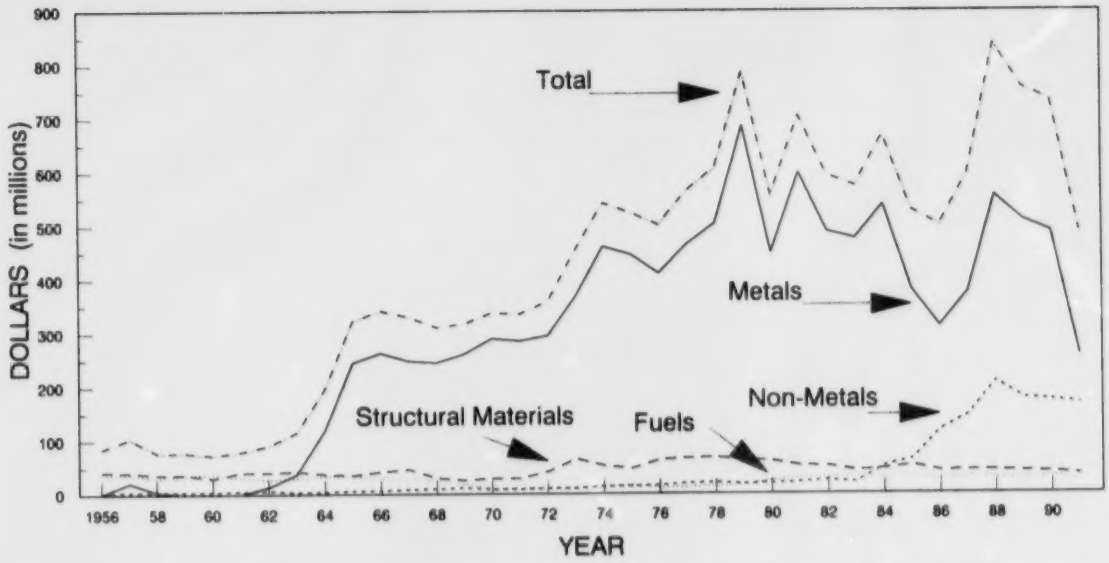


Figure 16. Value of mineral production in New Brunswick, 1956 to 1991 ($1986=100).

Silver prices remained low but stable, as did the value of silver's contribution ($22 869 000) to the metals sector. The Murray Brook mine continued to be the Provinces only primary gold producer, with BM&S contributing gold as a byproduct to the total value of this precious metal. Murray Brook operated for the entire year in excess of design capacity and metal recovery.

The nonmetals sector of the industry contributed 34.4% of the value of mineral production, up considerably from its 23% share in 1990 (Figure 16). This increase was due to the significant decline in the base-metals sector because the actual contribution of nonmetals ($212 321 987) was up only marginally over last year. Potash remains the most significant contributor to this sector, with production up slightly against a modest decline in price. Peat ranks second in value in the nonmetals sector at $26 934 202, with salt and sulphur in third place. A minor amount of marl also contributes to this sector. Other than peat and potash, most provincial industrial minerals (nonmetals and structural materials) are consumed domestically. Therefore, sales and production are sensitive to the local economy.

The value of coal produced by N.B. Coal Limited in Minto was $34 200 000. This represented a slight drop in production from 1990 levels. Oil was not produced in the Province during 1991 and there was no significant yield of natural gas.

The value of production for structural materials (lime, clay, stone, sand and gravel) was $44 939 842, down marginally from the previous year's value. These commodities provide the raw materials for the construction industry in New Brunswick.

In 1991, New Brunswick was the only producer of marl and ranked first in Canada in the production of bismuth; second in lead, potash, and peat; and third in zinc, silver, and sulphur from smelter gas (Table 6). Overall, New Brunswick ranks eighth out of twelve provinces and territories in its value of mineral production.

EMPLOYMENT

The mineral industry employed an average of 4550 people in 1991, down from the previous year's average of 4730. This downturn can be attributed mainly to the downsizing at the Brunswick Mining and Smelting Corporation Limited mine and smelter.

The following gives employment by sector in the mineral industry for 1991: Metals (2281); Potash (948); Coal (191); Peat (1001); Structural Materials (129).

Scientific, technical, administrative, and casual personnel employed by the Province in support of mineral resource development totalled 65.5 for 1991.

METALLIC MINERALS

Brunswick Mining and Smelting Corporation Limited 21 P/5W

COMPANY Head Office: P.O. Box 45, Commerce Court W., Toronto, Ontario M5L 1B6 Telephone: (416) 982-7111; Mine Office: P.O. Box 3000, Bathurst, New Brunswick E2A 3Z8; Smelter Office: P.O. Box 2000, Belledune, New Brunswick E0B 1G0. The Chairman and CEO is J.C. White.

RIGHTS In 1962, Brunswick Mining and Smelting Corporation Limited was granted surface and mineral rights to the No. 12 mine property.

LOCATION Brunswick operates one mine (No. 12), a concentrator, a lead smelter, and a fertilizer plant. The Brunswick No. 12 mine is located about 24 km west of Bathurst in

TABLE 6. RANK OF THE PROVINCES AND TERRITORIES
IN VALUE OF PRODUCTION FOR LEADING MINERALS IN CANADA, 1991 (P)
(Compiled from Energy, Mines and Resources Statistics)

Mineral	NF	PE	NS	NB	PQ	ON	MB	SK	AB	BC	YT	NT	Total Value Canada ($000 000 000)
Antimony				2						1	4		1.099
Bismuth				1						2			1.043
Cadmium	5		6	5	4	1	3	7		2		3	7.837
Clay Products	x		x	x	x	1	x	x	x	x			139.411
Coal			4	5				3	1	2			1 905.900
Copper			x	5	3	2	4	x		1			2 101.168
Gold	x		x	x	2	1	7	6	8	3	5	4	2 355.325
Lead			x	2		x	5			3	1	4	203.864
Lime				x	x	1	x		2	x			186.287
Marl				x									x
Peat	4		x	2	1		x	x	3				91.675
Potash				x				x					918.994
Salt			x	x	x	1		3	2				258.585
Sand and Gravel	9	12	8	7	4	1	5	6	2	3	11	10	631.391
Silver	x		x	3	4	2	6	x		1	5	7	185.261
Stone	7		3	5	2	1	6		9	4		8	512.837
Sulphur (in smelter gas)	6		8	3	2	1	7			4	8	5	76.592
Zinc	8		x	3	6	2	7	x		5	4	1	1 350.970

x Confidential information under the Statistics Act of Canada.
(P) Preliminary estimate

Gloucester County (Lat. 47°28.5'N and Long. 65°53.5'W). The concentrator is adjacent to the No. 12 mine; the lead smelter and fertilizer plant are located at Belledune Point, about 45 km from the No. 12 mine (Figure 17).

HISTORY Although sulphides were noted in 1907, it was the drilling of ground electromagnetic targets in 1952 that located the No. 6 deposit. Investigation of another electromagnetic anomaly on strike pin-pointed the site of the No. 12 mine in 1953. The property was granted to Brunswick Mining and Smelting Corporation Limited, which was controlled at that time by St. Joseph's Lead Company. During the period 1953–57, an open pit was excavated and a pilot mill was constructed at the No. 6 location. In 1961, interest was transferred to M.J. Boylen, K.C. Irving, and Patino Corporation. Development commenced at No. 12 in 1962 and mine production began in 1964. Production began at No. 6 mine in 1966. In 1967, Noranda invested $50 000 000 and gained control of Brunswick Mining and Smelting Corporation Limited. Noranda proposed a $50 000 000 expansion, which was started in 1974 and completed in 1981. A total capital expenditure of $69 000 000 was made at the mine and smelter between 1979 and 1981. The No. 6 mine was exhausted in 1983.

In 1985, the adjoining Belledune fertilizer plant, which produces a diammonium phosphate fertilizer product using sulphuric acid produced by the smelter, was purchased by Brunswick Mining and Smelting Corporation Limited. Deepening of the Brunswick No. 3 shaft to 244 m, which began in 1986, was completed in 1988.

The conversion from mechanized cut-and-fill mining to open stoping, which is expected to be completed in 1991, is a means by which Brunswick hopes to reduce mining costs.

On July 1, 1990, 1100 mine workers went on strike after rejecting the company's final contract offer. They were followed by 440 smelter workers on July 21, 1990. The major concerns of the union workers were wages, length of contract, cost of living allowance (COLA), and pension. During this period mine management continued to operate the mine at approximately 20% to 25% capacity.

EMPLOYEES In 1991, there were 1310 regular and contract employees at the mine and an average of 610 employees at the smelter and fertilizer plant.

RESERVES

Ore Reserves	Proven	Probable
Tonnes (x 1000)	70 188	13 752
Copper (%)	0.29	0.41
Zinc (%)	8.87	9.10
Lead (%)	3.59	3.62
Silver (g/t)	99.9	110.1

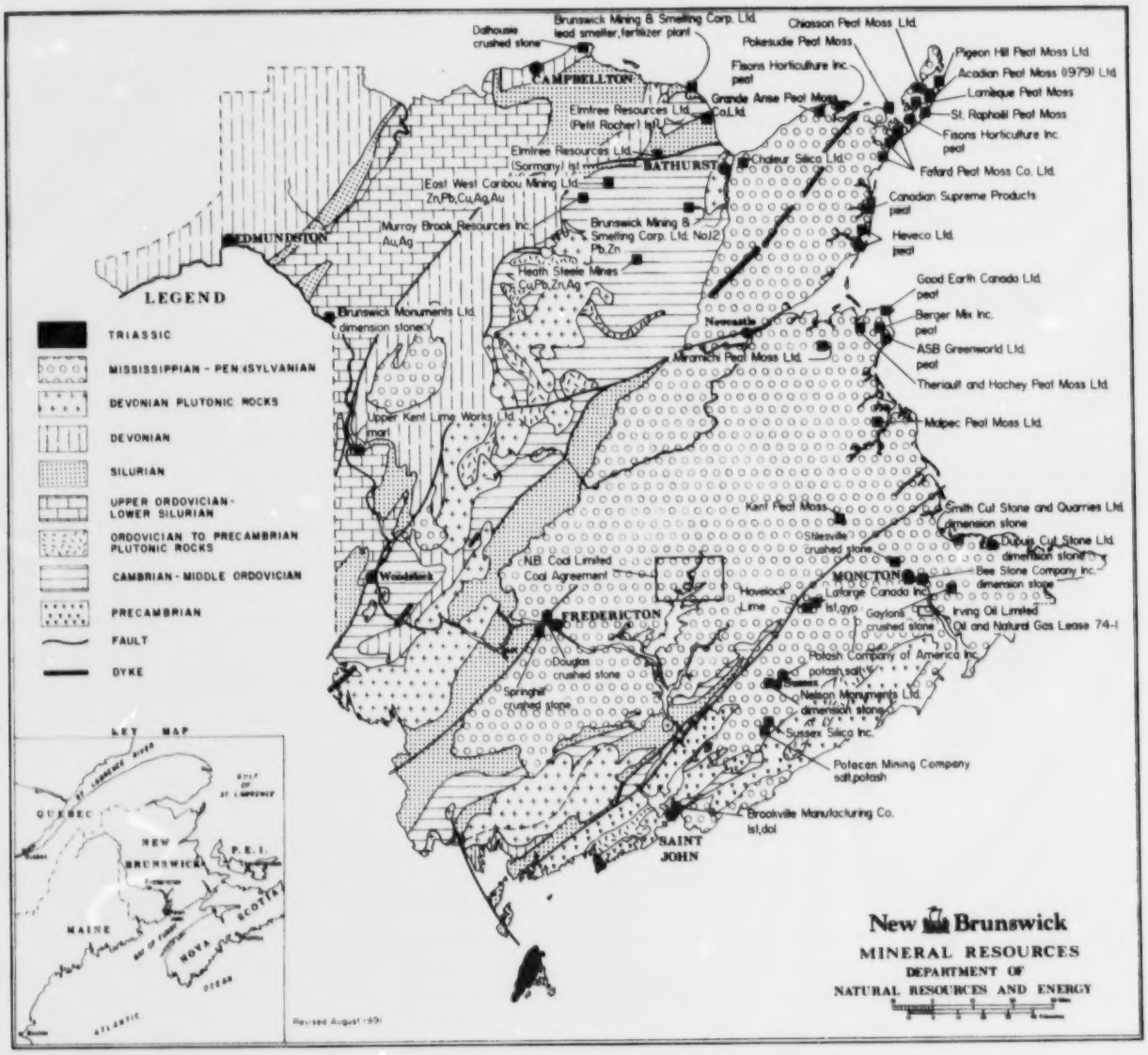


Figure 17. Nonrenewable resource producers in New Brunswick in 1991.

PRODUCTION In 1991, 2 530 000 t of milled ore was produced.

Production	Copper	Lead	Zinc	Silver/Bulk
Grade	0.42%	3.28%	8.44%	103 g/t Ag
Recovery	56.2%	57.8%	80.9%	49.2% Ag
Concentrate	26 850 t	78 540 t	312 470 t	37 670 t bulk

DEVELOPMENTS Brunswick Mining and Smelting Corporation Limited mines Canada's largest zinc deposit and operates the world's largest zinc mine.

Brunswick Mining and Smelting Corporation Limited began 1991 still in the middle of a severe labour dispute that had begun in July 1990. The strike included members of both union locals representing a total of 1540 mine and smelter workers. There was limited conflict or confrontation between the union and management; however, the union did receive fines for disrupting train access to both the mine and the smelter. The final few months of 1990 were relatively quiet and the strike ended in May of 1991.

The company has indicated that it plans to reduce costs at the facility by 10% and has laid off employees at both the smelter and mine. These were accomplished through early retirement and voluntary severance with the ultimate aim of 900 people employed at the mine and 300 at the smelter. The smelter has embarked on a plan to make itself a profitable operation. An upgrade of the concentrate from 34% to 45% has been required. Production at the fertilizer plant has been limited due to low sulphuric acid output; however, a $5 300 000 hot-gas precipitator is being installed to clean sinter plant gases. In addition, a new waste water treatment plant to treat acidic waste water from both the No.6 and 12 sites has been designed and work is expected to commence in the second quarter of 1992.

Indications are that there were valuable lessons learned by management and staff during the strike that will aid in the reduction of costs. In addition, the conversion of the mine from mechanized cut-and-fill to open stoping on the 850 level has also contributed to lower costs and improved efficiency. To date, costs have been reduced by 15% at the mine and productivity has increased by 30%, but this has not been sufficient to cover the losses caused by reduced metal prices and the current recession. Brunswick had a loss of $29 000 000 in 1991.

Zinc and bulk concentrates continue to be shipped to foreign ports from Brunswick's port facilities in Belledune, also the location of the lead smelter and fertilizer plant. In addition to lead, the smelter produces significant quantities of antimony, bismuth, copper, gold, and silver. Sulphur dioxide smelter gas is used to make sulphuric acid, a key component in the manufacture of diammonium phosphate (DAP) fertilizer that is produced at the adjacent plant.

Reclamation of the No. 6 mine site continued with the neutralization of acid-generating material by disposal of waste rock into the No. 6 pit. Revegetation was also carried out on the No. 12 property. The generation of thiosalts in the tailings drainage continues to be Brunswick's major environmental concern.

East West Caribou Mining Limited 21 0/9W

COMPANY East West Caribou Mining Limited, P.O. Box 26, Bathurst, N.B. E2A 3Z1. The Mine Manager is K. Whalen. Telephone: (506) 548-9863.

RIGHTS East West Caribou Mining Limited, which holds Mining Lease 246 under the Mining Act, Chapter M-14.1, S.N.B. 1985, is owned by Breakwater Resources Ltd.

LOCATION The Caribou deposit is approximately 40 km west of Bathurst in Restigouche County (Figure 17). (Lat. 47°34′N; Long. 66°17.6′W)

HISTORY The mineralization was discovered in late 1955 by Anaconda Copper Mining Company through regional geological mapping using aeromagnetic maps and photo interpretation. Ground EM pinpointed the drill target. Anaconda excavated an adit in the late 1950s, and in the late 1960s and early 1970s an incline was driven from the adit. During this time, a 907 t/d mill with a copper concentrator was constructed. Mining of secondary (near-surface) copper took place between November of 1970 and November of 1971. Metallurgical problems caused the operation to shut down. Production resumed in September of 1973 and continued for one year. In 1983 heap leaching of gossan was completed. Gold and silver extracted in 1983 amounted to 88 582.77 g and 1 688 018 g, respectively.

In late 1986, East West Minerals, N.L. of Sydney, Australia acquired Anaconda Canada Exploration Limited and Caribou Chaleur Bay Mines Ltd., which constituted the Caribou property. A decision was made in 1987 to proceed with the construction of a 2000 t/d mine/mill that would produce a lead–zinc bulk concentrate suitable for feedstock to an Imperial Smelting Furnace. Work began on the project in the latter part of 1987 and proceeded until the early part of 1988. At that time expected equity financing from stock market sources did not materialize. Financing for the project was eventually arranged through a five-year limited-recourse debt package of $30 000 000(CDN), organized through Westpac Banking Corporation and National Australia Bank Ltd., and the Royal Bank of Canada. A further $15 000 000(CDN) was made available through a silver debenture issue, 50% guaranteed by the Province of New Brunswick (Mining Journal, March 17, 1989).

On October 28, 1988 Caribou New Brunswick Mining received its Mining Lease, and subsequently changed its name to East West Caribou Mining Limited. Following the mine's official opening in June of 1989, the company found itself with severe production and financial concerns that resulted in the layoff of the majority of the workforce in August. This was followed by a period of restructuring and in January, 1990, the operation recommenced production. At that time, Bathurst Base Metals Inc. (controlled by British financier Howard Miller) held dominant interest in the operation. Breakwater Resources Ltd., who was contracted to manage the operation, subcontracted J.S. Redpath to implement the proposed modifications to the mine plan. In September, 1990, Breakwater secured 100% interest in the Caribou property through an amalgamation with Bathurst Base Metals Inc. The two companies agreed to restructure the mine's $30 000 000 debt with two Australian banks and Breakwater also agreed to fund the development of the mine to completion.

On October 26, 1990, East West Caribou Mining Limited announced the shutdown of the mine due to a significant decrease in the price of zinc, the current economic recession, and the Persian Gulf

crisis. At the time of closure the operation had exceeded planned daily production and was running at 2800 t/d. Any decision to restart the operation would be market driven.

EMPLOYEES 15 since suspension of operations.

RESERVES The mine contains proven reserves of 1 900 000 t of ore grading 7.93% zinc and 3.58% lead. In addition, there is an estimated 10 000 000 t of ore in the probable and possible categories.

PRODUCTION Secondary copper ore (825 552 t) was extracted from the open pit between November, 1970 and September, 1974. The average grade was 3.4% Cu.

DEVELOPMENTS East West Caribou Mining Limited has seen limited activity since the suspension of operations on October 26, 1990. The site has been maintained by a complement of 15 employees ensuring that the infrastructure is preserved for immediate start-up, as well as assuring the environmental integrity of any effluent leaving the site. The property is for sale and the parent company, Breakwater Resources Ltd., is actively seeking a buyer.

Discussions began in late 1991 with Arimetco International Inc. to form a joint venture to restart the operation using an acid leach/electrowinning technology. This technology would result in the production of a finished metal on site and would eliminate the expensive overseas smelting phase for Breakwater. If negotiations are successful in dealing with the debt owed to the Australian banks, the government of New Brunswick, and the local contractors, a six-month feasibility will be undertaken to evaluate the technology. A decision will then be made to either proceed or shut the property down unless another buyer can be located.

Heath Steele Mines, a Division of
Brunswick Mining and Smelting Corporation Limited 21 O/8

COMPANY The mine operates under the name Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited. The head office address is P.O. Box 45, Commerce Court West, Toronto, Ontario M5L 1B6. The mine office address is P.O. Box 400, Newcastle, New Brunswick E1V 3M5. Telephone: (506) 622-2100. The President and CEO is J.C. White and the Mine Manager is J. Martin.

RIGHTS In 1991, Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited, held Mining Lease 238 (Heath Steele deposit) and Lease 253 (Stratmat boundary deposit) under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Heath Steele mine is located 51 km northeast of Newcastle in Northumberland County (Lat. 47°17′N; Long. 66°05′W). The Stratmat boundary deposit (west zone) is located approximately 5 km northwest of the Heath Steele mill complex (Figure 17). (Lat. 47°13′N; Long. 66°07′W)

HISTORY The Heath Steele deposit was discovered in 1954 by airborne electromagnetic surveying. Mining began in 1957 but was suspended between 1958 and 1962 because of low metal prices and poor recoveries. The mine reopened in 1962 with a contract to treat the ore from Cominco's Wedge mine. In 1968, the mine began operating under the name Little River Joint Venture, managed and owned by AMAX (75%) and INCO (25%). In 1979, Noranda Exploration Company, Limited acquired AMAX's 75% share and ASARCO acquired INCO's 25% share.

On April 29, 1983 sulphide operations ceased because of low metal prices and diminished revenues. The plant was converted to treat gossan ores in order to recover gold and silver. This cyanide treatment process started in July, 1983. After some start-up problems, the plant operated well, treating a peak of 517 t/d. The gossan operations continued until October of 1984.

The Stratmat main (east) zone was discovered by Strategic Metals in 1956 following geophysical surveys. The company drilled holes 61-1 to 61-36 in 1956–57, then optioned the property to Cominco Limited in 1959. Exploration by Cominco led to the discovery of the boundary deposit (west zone) in 1961, and the stringer and central zones in 1972. The Stratmat north zone was discovered in 1980 following the drilling of geophysical anomalies. The boundary deposit lies on the boundary between the Heath Steele and Cominco properties.

Mineral dressing tests carried out at Heath Steele in 1982 were successful. In 1987, R.R. Irrinki of the New Brunswick Department of Natural Resources and Energy, Geological Surveys Branch, completed an ore reserve estimation for the property. In 1986, the boundary deposit was drilled by Brunswick Mining and Smelting Corporation Limited to obtain metallurgical samples. Preliminary results indicated good grade zinc, lead, and silver, and excellent recoveries.

In 1986, Brunswick Mining and Smelting Corporation Limited acquired ASARCO's 25% share in the Heath Steele mine and Noranda Exploration Company, Limited acquired the Stratmat property. Brunswick and Noranda each held 50% interest in the Stratmat property.

During 1988, Heath Steele Mines, a Division of Brunswick Mining and Smelting Corporation Limited, completed the Stratmat exploration programme and followed that with a feasibility study on the economics of reopening the Heath Steele property.

On February 20, 1989 a decision was made by Noranda to proceed with the reopening of the mine. Heath Steele Mines is a division of Brunswick Mining and Smelting Corporation Limited with both Brunswick and Noranda maintaining controlling interest in the operation. The fact that Heath Steele is able to share some common facilities with Brunswick was a major factor in the reopening of the mine. The commissioning of the Heath Steele mill began in September 1989 with a design capacity of 2200 t/d and mill feed scheduled from three zones on the property (Stratmat, B-zone, & E-zone). Initial milling results were not encourging; however, a consistent operating rate of 2900 t/d was achieved by co-milling the B-zone and Stratmat ores.

GEOLOGY Banded massive sulphides occur as boudins and dismembered layers within a high-strain zone in metasedimentary host rocks. Disseminated sulphides occur in the tectonized and illitized metasediments between the boudins.

The massive sulphides consists of fine- to medium-grained interbanded sphalerite–galena and pyrite, with local coarse-grained chalcopyrite. Vaguely banded pyrite–chalcopyrite occurs locally. Disseminated sulphides include medium-grained pyrite and/or sphalerite with smaller amounts of galena and chalcopyrite. The sulphide deposits and the metasediments are sandwiched between two polydeformed sequences of felsic crystal and lapilli tuffs ("Northwall and Southwall sequences"). Gabbro and diabase dykes cut the supracrustal rocks. All rocks are thought to be Middle Ordovician in age (Tetagouche Group). The shapes and attitudes of the sulphide-bearing zones are controlled by two dominant sets of folds.

EMPLOYEES 280 employees are on-site. Pre-shutdown employment was 600, indicating a dramatic increase in productivity from that time.

RESERVES The company continued to define reserves in the Stratmat S-1 and the Heath Steele C zones. The latter comprises 1 790 000 t of ore grading 7.42% Zn, 1.37% Pb, 0.84% Cu, and 61.52 g/t Ag. A near-surface extension of the C lens was also found.

Ore Reserves	Heath Steele		Stratmat	
	Proven	Probable	Proven	Probable
Tonnes (000s)	2 154	4 235	863	112
Copper (%)	0.68	1.22	0.30	0.63
Zinc (%)	6.35	5.51	7.40	9.99
Lead (%)	2.34	1.56	3.25	3.79
Silver (g/t)	69	70	41	29

PRODUCTION In 1991, 985 000 t of milled ore was produced at the Heath Steele mine.

Production	Copper	Lead	Zinc	Silver/Bulk
Grade	0.53%	2.66%	6.98%	57 g/t Ag
Recovery	59.9%	50.4%	81.0%	50.8% Ag
Concentrate	15 000 t	23 350 t	101 415 t	11 296 t bulk

The company produces zinc and bulk concentrate destined for Europe, lead concentrate for the Belledune smelter and Europe, and a copper concentrate for the Noranda smelter in Valleyfield, P.Q.

DEVELOPMENTS Production continued at Heath Steele throughout 1991, with positive results in the maintenance of planned mine production and mill recoveries; however, the company was also hard hit by declining base-metal prices. During 1991, the primary sources of ore were Stratmat and the B-zone, with two campaigns of ore from the CNE deposit. One of Heath Steele's key objectives is to extend its existing reserves and continue the operation into the next century through a comprehensive exploration programme. Much exploration has been carried out on the Heath Steele site. The most promising area is in the C-zone where significant underground exploration was conducted in the past. In the C-zone, 1 850 000 t of 7.6% Zn and 1.5% Pb has been outlined with good potential for more. Heath Steele Mines will be re-entering the underground at the C-zone in 1992 to further explore and prepare for future production.

Heath Steele completed its review of the economic feasibility of developing the C-zone in January of 1991 and received conditional approval from the Board of Directors to proceed with the two-phase development of the C-zone. Phase I consists of dewatering the A-pit and rehabilitating the ramp connecting the A-pit to the new C-zone and conducting underground exploration. An additional aspect of Phase I is to rehabilitate the 400 m No.4 shaft to allow for secondary access to the C-zone. Phase II, the development phase, will proceed based on the results of Phase I. If successful, the development of the C-zone could mean the extension of Heath Steele's mine life from 5 to 7 years. Noranda is actively seeking a partner to enter into a joint venture to fund Phase II and has stated that the sale of the entire Heath Steele property may be considered if the price is right.

In conjunction with this expansion in production, an EIA screening was performed with subsequent approval conditional to the posting of a $6 100 000 rehabilitation security. This security has been posted and work at the C-zone is proceeding; the draining of the A-pit is complete and the refurbishing of No. 4 shaft is underway.

In February, a pipe ruptured, spilling contaminated mine water into the Little South Tomogonops River. Heath Steele Mines embarked on a process to determine the impact of the spill on the river and its fish population as well as steps to ensure it does not happen again. Because of the incident, the company was taken to court by the Department of the Environment and was fined $30 000.

The extended strike at Brunswick Mining and Smelting Corporation Limited (BM&S) did not prevent Heath Steele Mines, a wholly owned subsidiary of BM&S, and its union from reaching a satisfactory agreement. Workers will receive an average increase of 21% over a 37.5-month contract commencing on November 14, 1990 and ending December 31, 1993.

Murray Brook Resources Incorporated — 21 O/9W

COMPANY The Murray Brook project is owned and operated by Murray Brook Resources Incorporated, whose parent company is NovaGold Resources Inc. The head office for NovaGold Resources Inc. is: Second Floor, 1583 Hollis St., Halifax, Nova Scotia, B3J 1V4. Telephone: (902) 420-0230. The President is Mr. Gerald J. McConnell; the Vice-President of Canadian Operations is Dr. William L. Young, P. Eng. The mine office address is P.O. Box 189, Beresford, New Brunswick E0B 1H0. Telephone: (506) 546-2550. The Mine Manager is C.N. Smith, P. Eng.

RIGHTS In 1991, Murray Brook Resources Incorporated held Mining Lease 252 under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Murray Brook gold, copper, zinc, lead deposit is located approximately 80 km west-southwest of Bathurst in Restigouche County (Figure 17). (Lat. 47°31.5′; Long. 66°25.8′) It is accessible via Highway 180 and a newly built access road.

HISTORY The deposit was discovered in 1956 by Kennco Explorations (Canada) Limited by tracing a stream-sediment anomaly to source, in claims that had been staked previously over airborne geophysical anomalies. The property was subsequently optioned to a number of companies including

Cominco Ltd., Gowganda Silver Mines Ltd., Canex Placer, and Northumberland Mines Ltd. Northumberland, primarily interested in the precious-metal content of the gossan, submitted a feasibility report, including a reclamation plan, in late 1986. Both of these were subsequently approved by the appropriate provincial government agencies, thus permitting Northumberland to proceed with the initial stages of mine development on the Murray Brook site. In 1988, Northumberland Mines Limited and the Murray Brook deposit were acquired by NovaGold Resources Inc.

Construction at the mine site began in March, 1989, and was completed by late summer. Production commenced in September and the mine was officially opened on October 27, 1989. Gold recoveries were greater than 80% and both milling and recovery rates exceeded the original design. The processing facility is one of only three of its type in the world and has features that enhance both its efficiency and environmental integrity. Because it is totally enclosed, ore can be leached on a year-round basis. Enclosure also ensures that airborne or liquid effluent from the operation is strictly controlled. Early gold recoveries (during the winter of 1990) were low; however, by using a preheater, the average recovery rate increased from 50% to 85%.

In addition to gold production, NovaGold embarked on an exploratory review of the copper zone beneath the gossan. A drilling programme (more than 1600 m) was conducted in late winter of 1988–89 to test the copper zone. Initial drilling, performed in advance of mining in the open pit, indicated approximately 330 000 t of ore grading 4.68% Cu.

GEOLOGY The deposit consists of a large low-grade massive sulphide body that is capped by a thick blanket of pre-Pleistocene gossan. Chloritic and calcareous mudstones (phyllites) are spatially associated with the sulphides—predominantly pyrite, sphalerite, chalcopyrite, galena, and arsenopyrite. The deposit sits within a sedimentary unit, dominantly phyllite, that is sandwiched between mafic volcanic rocks to the north and felsic volcanic rocks to the south, all of which belong to the Ordovician Tetagouche Group.

EMPLOYEES 35 permanent and approximately 14 contract employees at the mine site.

RESERVES A definition drilling programme conducted during the winter of 1990 showed mineral reserves in the gossan to be 1 700 000 t grading 1.51 g/t Au and 65.5 g/t Ag. Geological reserves of the copper zone are 356 360 t grading 4.58% Cu at a 2% Cu cutoff or 1 407 400 t grading 1.88% Cu at a 0.5% Cu cutoff.

DEVELOPMENTS The Murray Brook Mine continued to be a productive member of the mining community in 1991 and also continued to exceed design production and recovery rates. In 1991, the mine produced 631 774 g of gold and 5 409 365 g of silver at an average cost of $8.04/g; recoveries were 85% for gold and 17% for silver. The gold mining portion of the operation is expected to be completed in 1992 and the feasibility of mining the copper portion of the deposit remains under review. This has the potential of adding an additional 6 years of operation to the site. Murray Brook's parent company, NovaGold Resources Ltd., continues to seek new technology to facilitate the processing of New Brunswick ores. The company has been looking at the feasibility of processing the copper ore by using the ferric chloride leach process (FCL).

An initial study was done with the assistance of CANMET and results proved promising, so much so that NovaGold has entered into an agreement with CANMET to acquire a licence to use the process in New Brunswick and the Northwest Territories. FCL is an advanced technology for the efficient recovery of nonferrous metals from base-metal-sulphide ore. It has the potential to increase metal recoveries and revenues significantly and also has the capability of producing a finished metal as its final product, thus eliminating the environmentally undesirable smelting aspect of metal processing. NovaGold is currently striving to set up a pilot plant for the process somewhere in the Province, possibly at the Mount Pleasant property in Charlotte County.

NONMETALLIC MINERALS

PEAT

Thirteen groups (several divisions of the same company or several affiliated companies) were engaged in the production of peat moss in 1991.

Record total production was up by 23% from the previous year but shipments were down by about 6% (Figure 18). Baled peat accounted for 88% of the shipments; 12% of the peat shipped was in various forms of peat-based soil amendments and mixes. Most of the peat is bagged in the standard, 170 dm^3 format (59%). The global average unit value (including packaging) increased from $4.77 to $5.25 per standard bale. The total f.o.b. value of shipments in 1991 was $34 800 000.

The industry employed about 1000 persons, 89% of whom worked on a seasonal basis.

The total surface area of peatland developed for production in 1991 was 3500 ha. There are a total of 29 Crown peat leases covering 31 peatlands; 25 peat leases were in production. The industry's major markets are in the United States (57%); the Pacific seaboard countries of Asia, mainly Japan (23%); and Canada (19%).

Acadian Peat Moss (1979) Ltd.

COMPANY Acadian Peat Moss (1979) Ltd., P.O. Box 240, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2225. The President is Elphège Chiasson.

RIGHTS Acadian Peat Moss (1979) Ltd. holds Peat Moss Lease No. 13 (232 ha) on Bog 568 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 568 is adjacent to the Coteau Road on Lamèque Island, Gloucester County (Figure 17).

HISTORY Established in 1965, the company originally produced block-cut peat, but now produces only milled peat. Following a disastrous fire in 1981 the company resumed full production in 1982.

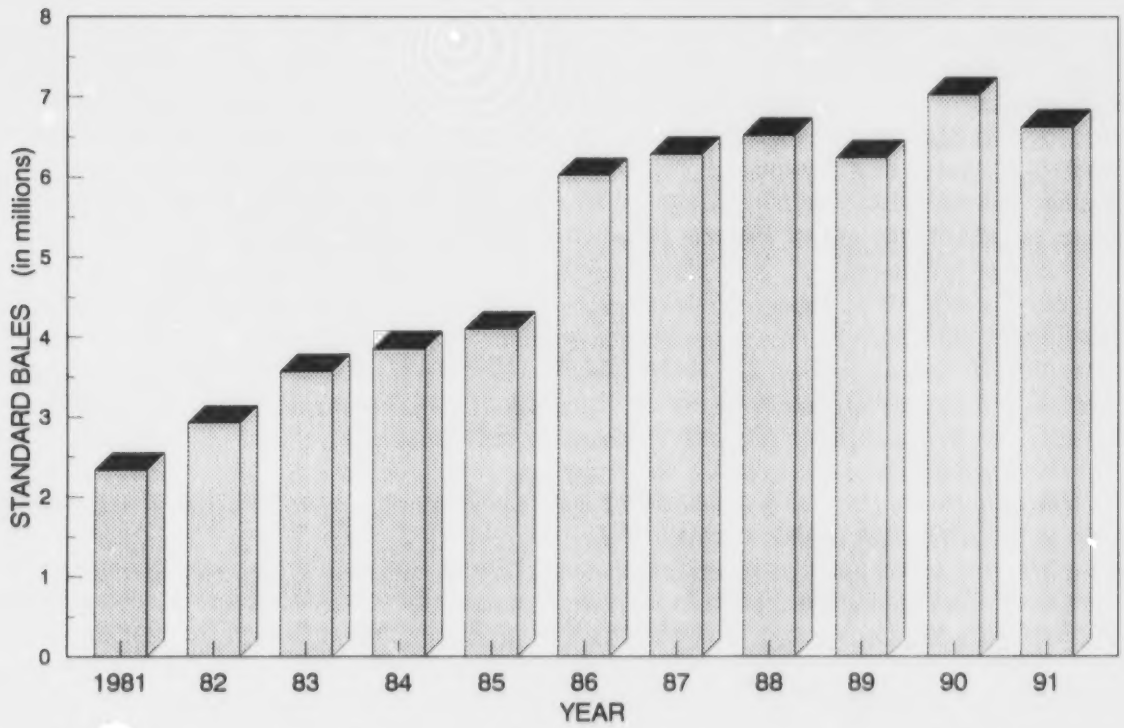


Figure 18. New Brunswick peat shipments, 1981 to 1991. A standard bale equals 0.170 m^3 of peat compressed at a ratio of 2:1, and having a 50% moisture content.

PRODUCTION The company produces baled peat.

DEVELOPMENT Continued expansion of existing lease. Construction of a storage building for loose peat.

EMPLOYEES In 1991, 12 to 46 persons.

ASB Greenworld Ltd.

COMPANY ASB Greenworld Ltd., Pointe-Sapin, Kent County, New Brunswick E0A 2A0. Telephone: (506) 876-3937. The Manager is Andreas Avenriep.

RIGHTS ASB Greenworld Ltd. holds Peat Moss Lease No. 19 (627 ha) on Bog 324E, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 324E is located 1 km northwest of Pointe-Sapin in Kent County (Figure 17).

HISTORY The company commenced site preparation in 1978 prior to acquiring a lease in 1982.

PRODUCTION The company produces baled peat and peat-soil mixes.

DEVELOPMENT Production continued at a rate consistent with market demand.

EMPLOYEES In 1991, 15 to 55 persons.

Berger Mix Inc.

COMPANY Berger Mix Inc., 121, R.R. #1, St-Modeste, Cté Rivière-du-Loup, Québec GOL 3WO. The President is Claudin Berger. Telephone: (418) 862-4462.

RIGHTS Berger Mix Inc. holds Peat Moss Lease No. 29 (603 ha) on Bog 337, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 337 is adjacent to Highway 117, 2 km north of St-Camille, Kent County (Figure 17).

HISTORY In 1985, Berger Mix Inc. acquired a Peat Exploration Licence that was converted to a Peat Lease in 1986. Production began in 1987.

PRODUCTION The company produces milled peat.

DEVELOPMENT The company continued to expand its production fields.

EMPLOYEES In 1991, 2 to 37 persons.

Canadian Supreme Products

COMPANY Canadian Supreme Products, P.O. Box 570, Lamèque, New Brunswick. EOB 1VO. Telephone: (506) 344-2293. The manager is Laurie Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 16 (413 ha) on Bogs 516 and 517, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bogs 516 and 517 are located 1.5 km east of Rivière-du-Portage, Northumberland County (Figure 17).

HISTORY Portage Peat Moss Ltd. started commercial production in 1972. In 1985, Canadian Supreme Products Ltd., a subsidiary of Lamèque Quality Group Ltd., acquired the operation. The company suspended operations in 1989. A resource evaluation survey was completed in 1990. In 1991, production resumed on selected portions of the bog.

PRODUCTION Some milled peat.

DEVELOPMENT None in 1991.

EMPLOYEES 0 to 2.

Chiasson Peat Moss Ltd.

COMPANY Chiasson Peat Moss Ltd., P.O. Box 112, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2426. The President is Gilles Haché.

RIGHTS Chiasson Peat Moss Ltd. holds Peat Moss Lease No. 23 (76 ha) on Bog 567 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 567 is located 3 km southeast of Petit-Shippagan (Figure 17).

HISTORY The company acquired an Exploration Licence in 1982 and converted to a lease in the same year. Before 1987, all the production was processed at the facilities of Acadian Peat Moss (1979) Ltd. A bagging plant was installed on site in 1987.

PRODUCTION The company produces baled peat.

DEVELOPMENT Baled peat production continued.

EMPLOYEES In 1991, 1 to 15 persons.

Fafard Peat Moss Co. Ltd.

COMPANY Fafard Peat Moss Co. Ltd., P.O. Box 70, Shippagan, Gloucester County, New Brunswick. Telephone: (506) 336-3715. The Manager is René Martin.

RIGHTS Fafard Peat Moss Co. Ltd. holds Peat Moss Lease Nos. 4 (364 ha), 5 (506 ha), and 6 (607 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bogs are in Gloucester County (Figure 17).

Lease	Bog No.	Size (ha)	Location
4	530	364	Pokemouche Bog, off Route 113 at Inkerman
5	532	506	Six-Roads Bog, 15 km south of Shippagan
6	529	607	Inkerman Ferry Bog, 8 km southwest of Shippagan

HISTORY The company began operations in New Brunswick in 1942 by opening a bog near Shippagan (Bog 530). New plants were opened in 1955 at Six-Roads (Bog 532) and in 1960 at Inkerman Ferry (Bog 529). Initial production was block-cut peat but by 1973 the entire operation had changed to milled peat. Since 1985, the production of peat mixes has become an important aspect of the New Brunswick operation.

PRODUCTION The company produces baled peat and peat mixes.

DEVELOPMENT Continued to develop the remaining potential on Bogs 529 and 532. A perlite-vermiculite processing plant and a new peat-mix plant were built in 1989.

EMPLOYEES In 1991, 10 to 144 persons.

Fisons Horticulture Inc.

COMPANY Fisons Horticulture Inc., Maisonnette, New Brunswick E0B 1X0. Telephone: (506) 727-3428. The Manager is Clarence Breau.

RIGHTS Fisons Horticulture Inc. holds Peat Moss Lease No. 10 (1406 ha), No. 12 (396 ha) and No. 26 (318 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION (Figure 17)

Lease	Bog No.	Location
10	591	2 km south of Lamèque
	592	4 km southeast of Lamèque
12	562	6 km west of Lamèque at Maisonnette
26	527	1 km south of the centre of Shippagan

HISTORY In 1929, Western Peat Company Limited (the forerunner of Western Peat Moss Ltd.) commenced operations on a small sphagnum bog in Whalley, British Columbia. In 1963, the original shareholders sold their interests in Western to an American company, Red Wing Peat Corporation. Western became the Canadian producing company, and Red Wing assumed the responsibility for marketing the company's products in the United States. In 1964, following up work that had begun earlier, a base of operations was established at Maisonnette (Bog 562). In 1970, Red Wing established a second base of operations in New Brunswick when it purchased Atlantic Peat Moss Co. Ltd. at Shippagan. Atlantic had produced from Bog 527 (1953–71) and from Bog 591 since 1952. In 1974, S.B. McLaughlin Associates Limited of Toronto, Ontario, purchased the holdings of the major shareholder, Red Wing, and assumed control. This was followed by the combination of the business operations of Western and Atlantic into Western Peat Moss Limited. In 1980, Fisons, a British company, acquired a 50% interest in Western Peat Moss Limited. The joint venture company was renamed Fisons Western Peat Moss Limited and then changed to Fisons Western Corporation in January 1982, when Fisons acquired the remaining McLaughlin interests. Bog 527 was abandoned in 1971 due to fire hazard to the town of Shippagan and converted to Peat Lease 26 in 1984. The new

plant on Lamèque Island (Bog 591) opened in 1981. The company changed its corporate name to Fisons Horticulture Inc. in 1989.

PRODUCTION The company produces baled peat and peat mixes.

DEVELOPMENT Development continued on Bog 591, eventually leading to development of Bog 592.

EMPLOYEES In 1991, 35 to 176 persons.

Good Earth Canada Ltd.

COMPANY Good Earth Canada Ltd., 5960 Broadway, Lancaster, N.Y. 14086, U.S.A. Telephone: (716) 684-8111. The President is Guenter Burkhardt.

RIGHTS Good Earth Canada Ltd. holds Peat Moss Lease No. 30 (734 ha) on Bog 338, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 338 is located at Point Escuminac, 50 km east of Chatham, Kent County. (Figure 17).

HISTORY The company was issued a Peat Lease in 1986 following the cancellation of Peat Lease No. 21 (Gulf Peat Co. Ltd.) on January 31, 1986. Production began in 1987.

PRODUCTION The company produces milled peat.

DEVELOPMENT Site preparation included land clearing and excavation of drainage ditches.

EMPLOYEES In 1991, 2 to 27 persons.

Grande Anse Peat Moss Co. Ltd.

COMPANY Grande Anse Peat Moss Co. Ltd., P.O. Box 90, Grande-Anse, Gloucester County, New Brunswick E0B 1R0. Telephone: (506) 732-2854. The President is Paul Tocci; the Manager is Patricia Whelton.

RIGHTS Grande Anse Peat Moss Co. Ltd. holds Peat Moss Lease No. 8 (166 ha) on Bog 561, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 561 is 3 km southeast of Grande-Anse (Figure 17).

HISTORY The company started block-cut peat operations in 1961 by hand cutting, but converted to mechanization in 1966. The conversion to milled peat began in 1977.

PRODUCTION Company produces baled peat.

DEVELOPMENT Continued production.

EMPLOYEES In 1991, 1 to 47 persons.

Heveco Ltd.

COMPANY Heveco Ltd., P.O. Box 30, Tabusintac, Northumberland County, New Brunswick E0C 2A0. Telephone: (506) 779-9277. The Manager is Myles Wishart.

RIGHTS Heveco Ltd. holds Peat Moss Lease No. 9 (1080 ha) and No. 24 (174 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 522 (Lease 24) is 2 km east of Brantville and Bog 524 (Lease 9) is 2 km southeast of Tabusintac (Figure 17).

HISTORY The company, incorporated in 1962, produces block-cut peat and peat mixes. Milled peat production commenced in 1981. Production on Bog 522 began in 1989.

PRODUCTION The company produces block-cut and milled peat, and peat mixes.

DEVELOPMENT Continued production. Some block-cut fields have been resurfaced to accomodate milled peat operation.

EMPLOYEES In 1991, 6 to 130 persons.

Kent Peat Moss

COMPANY Kent Peat Moss, R.R. #2, Saint-Paul, Kent County, New Brunswick E0A 2B0. Telephone: (506) 955-3098. The Manager is Eloi Maillet.

RIGHTS Fafard Peat Moss Co. Ltd. (P.O. Box 70, Shippagan, New Brunswick, EOB 2PO; Telephone: (506) 336-2325) holds Peat Moss Lease No. 25 (393 ha) on Bog 41, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 41 is located 0.6 km west of Birch Ridge, Kent County (Figure 17).

HISTORY Les Équipements Tardif Inc. acquired a Peat Exploration Licence in 1982 and converted to a Peat Moss Lease in 1983. In 1987, Fafard Peat Moss Co. Ltd. acquired the operation.

PRODUCTION The company produces milled peat.

DEVELOPMENT Survey and resource evaluation of adjacent Bog 40.

EMPLOYEES In 1991, 1 to 39 persons.

Lamèque Peat Moss

COMPANY Lamèque Peat Moss, P.O. Box 570, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2293. The Manager is Florent Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 14 (142 ha) on Bog 580 and Peat Moss Lease No. 28 (104 ha) on Bog 578, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 580 is 4 km north of Lamèque and Bog 578 is 2 km north of Petite-Lamèque, both in Gloucester County (Figure 17).

HISTORY Established in 1971, Lamèque Peat Moss Ltd. became a division of Lamèque Quality Group Ltd. in 1989. Production on Bog 578 began in 1989.

PRODUCTION The company produces milled peat and fish-based peat compost.

DEVELOPMENT Lamèque Peat Moss continued to develop the Crown portion of the bog to its full potential.

EMPLOYEES In 1991, 10 to 50 persons.

Malpec Peat Moss Ltd.

COMPANY Malpec Peat Moss Ltd., P.O. Box 118, Rexton, New Brunswick EOA 1L0. Telephone: (506) 523-9161. The President is Solomon Curry.

RIGHTS Malpec Peat Moss Ltd. holds Peat Moss Lease No. 20 (249 ha) on Bog 213 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 213 is located 3 km west of Rexton, Kent County (Figure 17).

HISTORY The company was issued a Peat Moss Lease in 1982. It commenced milled peat production in 1985.

PRODUCTION The company produces milled peat.

DEVELOPMENT The company continued to expand production fields.

EMPLOYEES In 1991, 5 to 60 persons.

Miramichi Peat Moss Ltd.

COMPANY Miramichi Peat Moss Ltd., P.O. Box 240, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-2225. The manager is Gilles Haché.

RIGHTS Miramichi Peat Moss Ltd. holds Peat Moss Lease No. 31 (770 ha) on Bog 3, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 3 is located 10 km south of Bay du Vin. Access is by an upgraded woods road from Highway 11, near St. Margarets (Figure 17).

HISTORY Acadian Peat Moss (1979) Ltd. applied for a Peat Exploration Licence in 1986. A licence was issued in 1987. A Peat Lease was granted in 1988 to the newly formed affiliated company. Production began in 1989.

PRODUCTION The company produces milled peat.

DEVELOPMENT Expansion of production fields continued.

EMPLOYEES In 1991, 1 to 25.

Pigeon Hill Peat Moss Ltd.

COMPANY Pigeon Hill Peat Moss Ltd.. P.O. Box 639, Lamèque, New Brunswick E0B 1V0. Telephone: (506) 344-5653. The President is Edmond Chiasson.

RIGHTS Pigeon Hill Peat Moss Ltd. holds Peat Moss Lease No. 18 (234 ha) on Bog 569 under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 569 is located at Pigeon Hill on Lamèque Island, Gloucester County (Figure 17).

HISTORY Company acquired a Peat Moss Lease in 1979.

PRODUCTION The company produces milled peat.

DEVELOPMENT Pigeon Hill Peat Moss Ltd. continued to expand production fields. A hydrological survey of the bog was completed in 1990.

EMPLOYEES In 1991, 3 to 21 persons.

Pokesudie Peat Moss

COMPANY Pokesudie Peat Moss, P.O. Box 570, Lamèque, Gloucester County, New Brunswick EOB 1VO. Telephone (506) 727-3385. The Manager is R. Godin.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 7 (202 ha) on Bog 600, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 600 is located on Pokesudie Island (Figure 17).

HISTORY In 1960, a lease was granted to Bushland Products Limited. The lease was transferred to Atkins & Durbrow (N.B.) Ltd. in 1967. Following a disastrous fire in 1978, the plant was rebuilt and production resumed in late 1980. Pokesudie Peat Moss Ltd., a subsidiary of Lamèque Quality Group Ltd., acquired the property in 1988. The company became a division of the Lamèque Quality Group Ltd. in 1989.

PRODUCTION The company produces baled peat.

DEVELOPMENT Continued peat production. Cranberry production trials were carried out on abandoned parcels of bog.

EMPLOYEES In 1991, 1 to 31 persons

St-Raphaël Peat Moss

COMPANY St-Raphaël Peat Moss, P.O. Box 570, Haut-Lamèque, New Brunswick EOB 1VO. Telephone: (506) 344-7058. The Secretary-Treasurer is Florent Chiasson.

RIGHTS Lamèque Quality Group Ltd. holds Peat Moss Lease No. 17 (115 ha) on Bog 576, under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 576 is 4 km east of Haut-Lamèque, Lamèque Island (Figure 17).

HISTORY Peat Moss Lease No. 17 was acquired in 1977. St-Raphaël Peat Moss Ltd. became a division of Lamèque Quality Group Ltd. in 1989.

PRODUCTION Company produces milled peat.

DEVELOPMENT Continued peat production with bog operating at capacity.

EMPLOYEES In 1991, 1 to 33 persons.

Theriault and Hachey Peat Moss Ltd.

COMPANY Theriault and Hachey Peat Moss Ltd., R.R.#1, Baie-Sainte-Anne, Northumberland County, New Brunswick E0C 1A0. Telephone: (506) 228-4530. The President is Isaac Theriault; the Vice-President is Gary Williston.

RIGHTS Theriault and Hachey Peat Moss Ltd. holds Peat Moss Lease No. 11 (330 ha) on Bog 324W and Peat Moss Lease No. 27 (125 ha) on Bog 302A under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968.

LOCATION Bog 324W is located 6 km south of Eel River Bridge and Bog 302A is located 7 km south of Eel River Bridge, both in Northumberland County (Figure 17).

HISTORY The company was formed in 1963, but block-cut peat had been produced from the site since 1961. In 1977 the block-cutting operation was converted to a milled peat operation. The company acquired the Peat Moss Lease on Bog 302A in 1985.

PRODUCTION The company produces milled peat.

DEVELOPMENT Theriault and Hachey Peat Moss Ltd. is continuing to open new fields on Bog 324W. Production on Bog 302A began in 1990.

EMPLOYEES In 1991, 3 to 51 persons.

POTASH/SALT

Potacan Mining Company 21 H/12E

COMPANY Potacan Mining Company, P.O. Box 5005, Sussex, New Brunswick E0E 1P0. Telephone: (506) 839-2146. The General Manager is B. Boivin.

RIGHTS Potacan Mining Company holds a Potash Agreement (8887 ha), under Section 25(2) of the Mining Act, Chapter M-14.1, S.N.B 1985.

LOCATION The Potacan mine is located about 20 km southwest of Sussex, Kings County (Figure 17).

HISTORY The Salt Springs potash–salt deposit was discovered by the Department of Natural Resources in 1973. Subsequent exploration and development rights to a 120 km^2 reservation area were granted to International Minerals and Chemical Corporation (IMC). Full-scale exploration (22 drill holes) began in 1975, and was successful in confirming a significant orebody.

Despite extremely encouraging results of the drilling programme, IMC decided to sell the property to Denison Mines Limited of Toronto late in 1978. Construction of a 5-m-diameter exploration mine shaft was commenced in September, 1979, and reached a target depth of 835 m by 1982.

In December, 1980, Denison Mines Limited assigned a 40% interest to Potash Company of Canada Limited (Potacan). Potacan is owned jointly by Entreprise Minière et Chimique, and Kali und Salz Ag. Denison Mines Limited was the overall development manager, with potash sales being handled by Potacan.

A feasibility study completed in 1982 resulted in a production decision announcement on February 7, 1983.

Work on the No. 2 shaft, the production shaft, commenced in 1983, along with continued underground development and the construction of the surface infrastructure related to the mill facility, tailings storage, and brine disposal. By July, 1985, all preproduction work was completed and the first shipment of potash destined for Colombia was made on September 17, 1985.

In 1991, financial difficulties forced Denison to sell its interest in the property to its Potacan partners. The mines name was subsequently changed to the Potacan Mining Company.

RESERVES AND GRADE Underground exploration in 1982 has blocked out more than 41 000 000 t of 28.5% K_2O, sufficient for the initial 5 years of production. Together with the 22 surface drill holes, the underground work to date has established initial total reserves of 230 000 000 t of ore (proven and possible).

PRODUCTION Production commenced in July, 1985, and has been gradually building up to the operation's annual rated capacity of 1 300 000 product tonnes. In 1991, Potacan operated at near 90% of its rated capacity, representing a 16% increase over 1990 production levels.

DEVELOPMENT A new hydraulic backfill system was implemented in the mine during 1989. This system is intended to improve ore extraction rates. A new crystallization circuit in the mill raised recovery rates to 90.4%. Various improvements have been made in the mine and mill, which have resulted in increased ore extraction rates and better product quality.

EMPLOYEES Average of 565 persons in 1991.

Potash Company of America 21 H/11W, 14W
(a Division of Rio Algom Limited)

COMPANY Potash Company of America (a division of Rio Algom Limited), P.O. Box 1489, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-5445. The General Manager of Operations is Donald Roberts. Rio Algom Limited, 120 Adelaide St. W, Toronto, Ontario M5H 1W5.

RIGHTS Potash Company of America holds a Potash Agreement (19 165.5 ha), under Section 25(2) of the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Potash Company of America mine/mill facility is located on the north side of Highway 2, about 5 km east of Sussex, Kings County (Figure 17).

HISTORY Following the discovery of potash in the Plumweseep–Penobsquis area by the New Brunswick Department of Natural Resources in 1971, exploration and development rights covering a 360 km^2 reservation area were granted to the Potash Company of America in 1973. After a comprehensive exploration programme and feasibility study, the company decided to proceed with the construction of a 5-m-diameter exploratory mine shaft in the spring of 1978. The exploration shaft was completed in April and underground exploration in October of 1980. On October 27, 1980, the Potash Company of America announced that it was proceeding to production with a mine capacity of 900 000 t/a although initial capacity would be 630 000 t/a.

Mine development, mill construction, and the Courtenay Bay potash shipping terminal in Saint John were completed in 1983. The first potash was produced from the mill on July 17, 1983. The first shipment of potash through the port facility in Saint John took place early in 1984.

After purchasing PCA early in 1986, Rio Algom Limited spent more than $30 000 000 to improvements designed to bring the Sussex mine up to its rated capacity of 635 000 product tonnes per year by April of 1987.

RESERVES AND GRADE Sufficient tonnage has been indicated by drilling to support a 1 000 000 t/a plant for 20 years or more.

PRODUCTION Potash and salt production commenced in 1983. For the second consecutive year the facility operated above its rated design capacity in 1991.

DEVELOPMENT The company has made a considerable expenditure to improve the ore handling systems in the mine. In the mill, PCA has been working toward improving equipment uptime and boosting potash recovery rates. Recovery rates have improved significantly since start-up. Work continues on improvements to the tailings handling system.

EMPLOYEES Average of 365 persons for 1991.

LIMESTONE/DOLOMITE

Brookville Manufacturing Company 21 H/5

COMPANY Brookville Manufacturing Company, P.O. Box 2332, Station C, Saint John, New Brunswick E2L 3V6. Telephone: (506) 633-1200. The General Manager is M. Sanford.

RIGHTS R.H. Oland (Moosehead Breweries Ltd.) holds the Original King's Land Grant.

LOCATION Brookville, East Saint John, Saint John County (Figure 17). The quarry and crushing operations are located between Highway 1 (Sussex–Saint John Highway) and Highway 100 (Rothesay Highway), approximately 2 km east of their junction. Access to the quarry is via the Rothesay Highway.

HISTORY The company commenced operations more than 60 years ago, primarily producing agricultural limestone and aggregate. It has been operating almost continuously since that time.

RESERVES AND GRADE At present market levels, adequate reserves of stone are estimated for several more years. Although grade varies between areas of high-calcium limestone and dolomite throughout the quarry, the bulk of production is centred in the more dolomitic areas where grades fluctuate from 40 to 45% $MgCO_3$.

PRODUCTION The company produces about 140 000 t of aggregate products each year. These include agricultural dolomitic limestone, cement, asphaltic aggregate, and road metal.

DEVELOPMENT Continued operation with plans to investigate a high-calcium limestone deposit near Ketepec.

EMPLOYEES Up to 28 persons in 1991.

LIMESTONE/GYPSUM

Lafarge Canada Inc. (Havelock) 21 I/3W

COMPANY Lafarge Canada Inc. The plant address is R.R. #1, Havelock, New Brunswick E0A 1W0. Telephone: (506) 534-2301. The Manager is H. Kierstead.

RIGHTS Lafarge Canada Inc. holds Mining Lease 245 (632.5 ha), which includes existing plant and operating quarries, under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION Limestone quarries and cement plant are located adjacent to Highway 880, about 5 km east of Havelock, Westmorland County (Figure 17).

The company also maintains mineral rights to a gypsum quarry located less than 5 km north of Petitcodiac, Westmorland County.

HISTORY Limestone quarries near the plant have been supplying raw material for the manufacture of cement since 1952. In 1987, the company closed its cement production facility; however, it continues to quarry stone used for other purposes.

A new limestone quarry (the McGee quarry) was opened in 1986 just north of Highway 880, less than 1 km east of the plant. This quarry was opened in an area known to contain extensive reserves of high-calcium limestone. The property was partially investigated in 1976. A drilling

programme was undertaken in 1985 to further verify the quality and extent of the deposit prior to the establishment of the new quarry site.

Initial quarrying of gypsum at Intervale began in 1880. The Albert Manufacturing Co. produced 1179 t/a between 1932 and 1935. In 1950, the property was acquired by Canada Cement Company Ltd. (now Lafarge Canada Inc.) who had worked the quarry periodically until 1987.

RESERVES AND GRADE Reserves of high-grade limestone (i.e., 50–53% CaO) on properties held under Mining Lease by Lafarge Canada Inc. have been estimated between 75 000 000 t and 100 000 000 t. Reserves of the McGee quarry are estimated in excess of 10 000 000 t of limestone grading 50% CaO or better. At Intervale, reserves of 97% gypsum have been estimated to be slightly less than 4 000 000 t.

PRODUCTION Historically, the company has produced up to 400 000 t of limestone annually, primarily for use in cement manufacturing. However, since the closure of its plant, stone quarried for cement production has ceased. Despite the plant closure, Lafarge continued to produce stone from its McGee quarry through 1988. The company has a 10-year agreement with Havelock Lime (a Division of Dickenson Mines Ltd.) to supply up to 400 000 t of raw stone on a yearly basis.

Lafarge Canada Inc. also produces aggregate for its subsidiary, Permanent Concrete Ltd.

Gypsum has been produced from Intervale as required (5 000 to 25 000 t/a). However, due to the scale-down and closure of the Havelock cement operation, no significant production has been recorded in recent years. The property has been partially reclaimed.

DEVELOPMENT Continued operation. Stone is supplied to Havelock Lime.

EMPLOYEES 5 persons in 1991.

LIMESTONE

Elmtree Resources Ltd. (Petit Rocher) 21 P/13W

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas; the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Mining Lease 249 (245.9 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION The Elmtree quarry is located about 20 km north of Bathurst near the Village of Petit Rocher, Gloucester County (Figure 17).

HISTORY A quarry has existed on this site since 1880 and was operated on a 1800 t/a basis from 1930 to 1960 by Elmtree Co-op. Since 1960, it was operated on an intermittent basis until 1978 when it was acquired by Elmtree Resources Ltd. Following extensive trenching and mapping, the quarry was expanded to include a crushing and screening plant, and a large storage facility.

RESERVES AND GRADE Reserves appear to be adequate in the explored area for a few more years of operation at current production levels. The cutoff grade is 50% CaO.

PRODUCTION Approximately 60 000 to 90 000 t of limestone is quarried and crushed annually. It is sold primarily to the smelter at Belledune for flux. Some material is marketed as agricultural lime, construction stone, and fertilizer filler.

DEVELOPMENT Continued operation of quarries at the plant site. Eventually, the operation will be relocated to the Sormany area.

In 1991, Elmtree was selected by NB Power to supply limestone to its coal-fired Belledune generating station. Commencing in 1993, the station will require about 100 000 t/a of limestone for use in its acid gas scrubber. Elmtree will truck limestone from the Sormany quarry, situated 20–30 km south of the power plant.

EMPLOYEES Up to 15 persons.

Elmtree Resources Ltd. (Sormany) 21 O/9

COMPANY Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Executive Officer and President is A. Buzas, and the Manager and Vice-President is G.M. Doucet.

RIGHTS Elmtree Resources Ltd. holds Quarry Lease No. 27 (84.3 ha) under the Quarriable Substances Act, Chapter Q-1, R.S.N.B. 1968 as well as Mining Lease 248 (171.3 ha) under the Mining Act, Chapter M-14.1, R.S.N.B. 1986.

LOCATION This deposit is located about 30 km west of Bathurst, adjacent to the Millstream River (Figure 17).

HISTORY Although the limestones near Sormany were mapped by J.L. Davies in 1959, it was not until 1982 that Elmtree Resources Ltd. mapped and sampled the deposit in detail. Two holes were drilled to further test the extent and grade continuity of the limestone at depth. Results were encouraging enough to proceed with site preparation for quarry development.

RESERVES AND GRADES Initial exploration indicated possible reserves in excess of 4 000 000 t of high-grade calcic limestone (53.0% CaO) suitable for quicklime and hydrated lime production.

PRODUCTION Some stone has been quarried and hauled to the main crushing facility at Elmtree, where it has been marketed as agricultural (ag) lime and smelter flux (see Armstrong Brook dolomite).

DEVELOPMENT In 1991, Elmtree was selected by NB Power to supply limestone to its coal-fired Belledune generating station. Commencing in 1993, the station will require about 100 000 t/a of limestone for use in its acid gas scrubber. Elmtree will truck limestone from the Sormany quarry, situated 20–30 km south of the power plant.

EMPLOYEES Manpower provided by staff of Elmtree Resources Ltd.

Havelock Lime, a Division of Dickenson Mines Limited 21 H/13W

COMPANY Havelock Lime, P.O. Box 59, Havelock, New Brunswick E0E 1W0. Telephone: (506) 534-2311. The General Manager is L. Murray.

RIGHTS Dickenson Mines Limited holds Mining Lease 243 (282.9 ha) and Mining Lease 244 (182.4 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985. Lease 243 includes the operating quarry at Samp Hill and Lease 244 includes the plant.

LOCATION The company operates a quarry at Samphill, about 5 km west of Havelock. A processing facility is situated less than 1 km east of the Village (Figure 17).

HISTORY Havelock Lime, formerly Havelock Lime Works Ltd., has been quarrying in the area since 1939. The original company was incorporated in 1964, and in 1970 a subsidiary company, Havelock Processing Ltd., was formed to manage the manufacturing of quick and hydrated lime. In 1984, Dickenson Mines Ltd. purchased the Havelock group of companies.

RESERVES AND GRADE Less than 5 000 000 t of 95% $CaCO_3$ are estimated to remain at Havelock's Samphill quarry following current extraction practices. However, this tonnage can be increased if a greater overburden-to-stone stripping ratio can be economically achieved.

PRODUCTION The company has traditionally processed about 300 000 to 400 000 t of stone annually. Chemical process stone (for use as flux in nonferrous smelters, the glass industry, pulp and paper mills, and fibreglass), pulverized stone (for use in dusting mines and for agricultural purposes), poultry grit, and crushed stone (for use as concrete aggregate and for general construction) are among the products currently produced.

DEVELOPMENT Expansion over the last few years has included the construction of a new kiln. The 300 t/a annular-shaft kiln operated satisfactorily in 1990. The new kiln should realize significant fuel savings and provide long-term market competitiveness. Some stone is purchased from Lafarge Canada Inc. who operates a nearby quarry. A new 10 ton per hour hydrator has improved production efficiency. In August, 1991, a washing plant was commissioned, providing better quality stonefeed to the kiln. Havelock remains the only source of quick and hydrated lime in the Maritimes.

Although some limestone was purchased from Lafarge Canada Inc., most of Havelock Lime's requirements were supplied from the Company's Samphill quarry. Investigations continued into the quality-control problems associated with limestone from Lafarge's McGee quarry. Geological work, including drilling, proved up additional high-quality limestone reserves on the property just north of the Havelock processing facility.

EMPLOYEES An average of 54 persons in 1991.

Upper Kent Lime Works Ltd. 21 J/12

COMPANY Upper Kent Lime Works Ltd., R.R. 3, Bath, New Brunswick E0J 1E0. Telephone: (506) 278-5359. Contact person is Douglas Lloyd.

RIGHTS Upper Kent Lime Works Ltd. holds Mining Lease 242 (16.2 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This deposit of marl occurs in the bottom of a partially drained lake at Maplehurst, 15 km north of the Village of Bath (Figure 17).

HISTORY The deposit has been worked since the late 1950s and was acquired by the present owners in 1973.

RESERVES AND GRADE It is estimated that 25 000 to 30 000 t of marl ranging between 85% and 95% $CaCO_3$ remains at this location.

PRODUCTION The water level has been lowered slightly and the marl is within 1 m of the surface. Marl is extracted from the lake bottom by a drag line, spread on the adjacent hillside to dry, and stockpiled. It is then screened to remove pebbles, twigs, etc., and trucked to local farmers for use in potato fields. The main operating period is late April to June. An additional two- to three-week period of operation typically occurs in the fall to stockpile material. Annual sales are in the order of 2000 to 2500 t.

DEVELOPMENT Continued operation.

EMPLOYEES 3–4 persons

SILICA

Chaleur Silica Limited 21 P/12E

COMPANY Chaleur Silica Limited, c/o Elmtree Resources Ltd., P.O. Box 665, Bathurst, New Brunswick E2A 3Z6. Telephone: (506) 546-6382. The Manager is G. Doucet.

RIGHTS The deposit is owned by A. Ronalds and G. Ronalds under an original King's Grant and mined under an agreement with Chaleur Silica Limited.

LOCATION The Bass River silica quarry is located south of Highway 11, approximately 6.5 km east of Bathurst, Gloucester County (Figure 17).

HISTORY The property was originally explored by East Coast Smelting and Chemical Company in 1961, but the property remained undeveloped until 1974 when World Wide Explorations opened a small quarry. It was purchased by Godin M-E in 1976. The operation was expanded and modernized, and is now operated under the name Chaleur Silica Limited. A sandblast sand plant, with 77–91 t/d capacity of bagged sand, was installed in 1979.

In 1983, five holes were drilled on a second property adjacent to the Nepisiguit River. Ten metres of siliceous stone similar to that already being quarried was intersected.

RESERVES AND GRADE Reserves may exceed 500 000 t of 95% SiO_2; however, most is inaccessible due to ownership problems and proximity to the Bass River floodplain.

PRODUCTION The quarry operates on a seasonal basis and has produced up to 60 000 t of silica annually. Markets are almost entirely dependent on the sale of silica flux to the smelter at Belledune; however, some blasting sand and nursery sand have been produced.

DEVELOPMENT In 1988, the operation was sold to Elmtree Resources Ltd. who intends to maintain production, pending market demand. No production was reported in 1991.

EMPLOYEES N/A

Sussex Silica Inc. 21 H/12E

COMPANY Baskatong Quartz Ltd., P.O. Box 337, Sta. N.D.G., Montreal, Québec H4A 3P6. Telephone: (514) 482-6357; and Lockhart Exploration Services Ltd., P.O. Box 515, Fredericton, New Brunswick E3B 5A6. Telephone: (506) 472-2877. Mine Site: R.R.#3, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-5890. Mine Manager is Robin Turner.

RIGHTS Sussex Silica Inc. holds Mining Lease 241 (599.8 ha), under the Mining Act, Chapter M-14.1, S.N.B. 1985.

LOCATION This deposit of unconsolidated silica sand is about 16 km southwest of Sussex, immediately northeast of Cassidy Lake (Figure 17).

HISTORY The deposit was discovered in 1982. After identifying sufficient reserves of high-quality sand, a pilot plant was set up in 1983 for product testing and marketing. Full-scale production began in 1986.

RESERVES AND GRADE Approximately 9 000 000 t of silica sand (proven reserves) and more than 22 000 000 t of silica sand (possible reserves) containing greater than 98% SiO_2 are indicated.

PRODUCTION Production from this mine began in the fall of 1986, consisting of several thousand tonnes of lump silica and sand of various sizes. The lump silica was used in the manufacture of silicon metal and silicon carbide at Becancour, Québec. Existing capacity of the operation is estimated at 80 000 t/a.

DEVELOPMENT Plans to gradually expand into specialty marketable products including sand blasting material, filtration, tree nursery, decorative sands, and sands used in the manufacture of glass and fibreglass.

EMPLOYEES Up to 6 persons in 1991.

DIMENSION STONE

The New Brunswick stone industry today bears no resemblance to that of former decades. Nonetheless, half a dozen companies still quarry and work stone in the province, shaping it into monuments, curbing, streetscaping, new stone buildings and restoration material. These companies belong to three categories. The first entails those that use no local stone, but instead obtain rough blocks from out-of-province, then process them within New Brunswick for monumental purposes. The sole member of this category is Brunswick Monuments Ltd. of Grand Falls. Several more companies fall into the second group—those that import finished foreign monuments and engrave them on site—but they are not described here. The third group comprises firms that handle both foreign and/or New Brunswick stone. It consists of Nelson Monuments Ltd. of Sussex, Smith Cut Stone and Quarries Limited of Shediac, Bee Stone Company Inc. of Dieppe, and Dupuis Cut Stone Ltd. of Shediac.

Brunswick Monuments Ltd.

The address for Brunswick Monuments Ltd. is P.O. Box 353, Grand Falls, New Brunswick E0L 1M0. Telephone: (506) 473-4753.

Roland Cyr owns and operates the only stone finishing works in northern New Brunswick. After apprenticing in the Québec stone industry, he opened his own monument business in 1972 on the Trans-Canada Highway five miles (8 km) west of Grand Falls in New Brunswick (Figure 17). The company imports granite as rough blocks from Québec, Ontario, South Africa, and the United States, and shapes them on site.

Some of the eight employees polish the stone slabs mechanically, each slab taking three to four hours to finish. Others reduce the slabs to monument-sized tablets using diamond saws. Workers prepare the stencils for lettering and decorative work by hand before engraving the monument face beneath a sandblast unit. Monuments are sold to clients across northern New Brunswick and Maine.

Nelson Monuments Ltd.

The address for Nelson Monuments Ltd. is P.O. Box 1220, Sussex, New Brunswick E0E 1P0. Telephone: (506) 433-3413.

Nelson Monuments Ltd.—the largest monumental company in Atlantic Canada—has historic links with one of the earliest monument men in New Brunswick, Josiah Tingley. The Tingley family began producing tombstones at Hopewell Cape in 1846 and steadily expanded over the next seventy years, hiring local people as business grew. In 1907 the Tingleys took on two young brothers named Percy and George Nelson. After two years' apprenticeship, the brothers established their own business two miles down the road at Lower Cape; there, they made monuments of native sandstone, and native and foreign granite.

The Nelson enterprise remained as a small family operation for about forty years until it passed to George's sons Maurice and Russell in the early 1950s. Together, the two men slowly changed the company's entire approach. First they incorporated into Nelson Monuments Ltd. in 1954. Five years later they moved from Lower Cape to a new stone finishing plant in Sussex and steadily built the business into the vibrant monumental and quarrying concern it is today.

Part of the Nelsons' strategy was to buy or lease quarry properties across New Brunswick. In this, they had variable success. Between 1957 and the early 1970s they obtained quarry rights to several lots at Hampstead. These have since proven viable and currently supply thirty to forty per cent of all stone used at the Sussex plant. Production consists of the pink Hampstead granite (now designated by the trade name *Coral Dawn*), and averages 200–280 m^3 annually.

Less successful were properties that the Nelsons attempted to develop in Charlotte County. They purchased the Spinney quarry in 1962 from Ken Fitzgerald, using its black granite as monumental material and also to make veneer for store fronts in Moncton, and the Centennial Building in Fredericton. In the mid- to late 1970s, they reopened quarries at Dawson Mountain (light pink) and Johnson Lake (black), providing stone from the former site to the Saint John Regional Hospital and other building projects. The quarries were not commercially feasible, however, and around 1980 Nelson Monuments ceased all activity in the area.

Today, the Nelsons work quarries at Hampstead (Figure 17) and also at Vermillion Bay in northern Ontario. All operations use the flame-jet cutting technology to extract stone whereby diesel fuel and compressed air are combined to produce a very concentrated, high-temperature flame like a blow torch. When applied to rock, the jet causes a narrow section of stone to spall and chip, creating a channel about four inches wide. As well, the quarries feature modern quarry bars, squaring equipment, and front-end loaders. Granite from Hampstead is trucked to the Sussex plant and manufactured into monument bases, streetscaping, curbing, bridge stone, and some veneer stone.

In addition to working stone from Vermillion Bay and Hampstead, the Nelsons import granite from South Africa, India, Norway, Finland and the United States for monumental or decorative purposes. The Sussex plant holds an array of computerized diamond saws, polishing tables and lettering facilities including a computer-assisted drafting machine similar to that used by Smet Monuments Ltd. The Nelsons employ about 65 people, half of whom work in New Brunswick. The

company has over two hundred sales representatives, and its monuments are bought by clients in Newfoundland, Nova Scotia, Prince Edward Island, the Gaspé coast, and southern Ontario. Its lettering and distribution plant in Waterloo, Ontario, is one of the most modern in Canada.

Bee Stone Company Inc.

The address for Bee Stone Company Inc. is P.O. Box 4369, Dieppe, New Brunswick E1A 6E9 Telephone: (506) 858-5566.

Bee Stone Company Inc. is wholly owned and operated by Fred Pellerin of Dieppe. He entered the stone business in the late 1980s and supplies sandstone for both new construction projects and the restoration market.

Pellerin became interested in dimension stone in 1985 after attending a course on heritage buildings. Since then, he has accumulated the quarry rights to valuable sandstone properties in Westmorland and Albert counties—quarries that, in some cases, exported millions of tons of dimension stone during the late 1980s. Having secured the stone properties, Pellerin is now busy delineating potential markets. This entails researching what heritage buildings in eastern North America contain the stone, and which ones might require restoration.

To date, Bee Stone Company Inc. has fulfilled restoration contracts, providing material from the Boudreau quarry (Figure 17) to repair Monument Lefebvre in St-Joseph and stone bridges in Central Park in New York City. Stone finishing has been carried out in cooperation with Smith Cut Stone and Quarries Limited of Shediac and Nelson Monuments Ltd. of Sussex. Other restoration and construction projects and related opportunities are being pursued.

Dupuis Cut Stone Ltd.

The address of Dupuis Cut Stone Ltd. is P.O. Box 278, Shediac, New Brunswick E0A 3G0. Telephone: (506) 532-4363.

Alex Dupuis, president of Dupuis Cut Stone Ltd., is a brick mason by trade. He entered the stone business in the 1980s. The Dupuis fabrication facility near Shediac (Figure 17) contains some of the most sophisticated equipment in the business: laser guiding devices, computer-operated cutting saws, and other modern machinery. Since setting up the shop, Dupuis has supplied stone for various projects including restoration to part of the Ottawa Parliament buildings, and for the New Brunswick Museum in Saint John.

Smith Cut Stone and Quarries Limited

The address for Smith Cut Stone and Quarries Limited is P.O. Box 69, Shediac, New Brunswick E0A 3G0. Telephone: (506) 532-6902.

Smith Cut Stone and Quarries (or, more precisely, its antecedents) is the oldest existing stone company in New Brunswick. From the 1860s onwards, the Smiths quarried sandstone on and near Scoudouc River at Shediac (Figure 17) for grindstones and rubble stone. Since about 1930, the company has been actively involved in producing dimension stone and veneer material of stone from its own olive green quarry as well as from other sources. Smith pursued the building stone market vigorously and within a few years the company secured many contracts to supply trim stone for brick buildings, and dimension stone for major structures across southern New Brunswick and (in one case) Québec.

One of the most highly regarded Acadian stonemasons, Arthur LeBlanc, became Smiths' quarry superintendent in 1934. Arthur oversaw stonework on most Smith contracts until well into the 1970s. In 1968, the entire stone enterprise was sold to Arthur's son, Roy. Roy LeBlanc is now president of the organization, which in 1968 became incorporated as Smith Cut Stone and Quarries Limited.

After 1954 the company stopped using stone from its Shediac property and concentrated instead on cutting material from other sources such as Queenston limestone from Ontario, red sandstone from the Pickard quarry in Sackville, and sandstone from Wallace, Nova Scotia. The change occurred for several reasons.

In 1970–80, Roy LeBlanc and his employees excavated stone in Sackville, cut it in Shediac, and returned it to Mount Allison campus to construct the Roy Crabtree Building. In 1981, LeBlanc leased another red sandstone quarry outside of Sackville to supply material for the Confederation Square building in Toronto.

The Smiths' own Shediac quarry has been reactivated once since 1954, to supply stone for an addition to Moncton High School that was built of Shediac stone in 1934.

Today, the Smith Cut Stone and Quarries facilites operate on demand. Recent projects have entailed more restoration than new construction work. In 1988–89 the company fulfilled a joint contract with CanStone Inc. of Halifax to restore the Legislative Building in Fredericton employing Wallace stone; and in 1989 Fred Pellerin of Bee Stone Company Inc. used the Smith plant to cut stone for a nearby restoration project.

The Smith Cut Stone and Quarries plant remains functional and occasionally is leased to independent operators. The quarry, too, can furnish moderate quantities of restoration stone.

CRUSHED STONE

Major operations producing crushed stone for use as aggregate are centred around the Fredericton and Moncton areas. Both of these areas are deficient in good quality, coarse, surficial, granular aggregate materials.

In the Fredericton area, Diamond Construction Limited maintains a crushing operation at Springhill, on the south side of the Saint John River (Figure 17). The material crushed is a Silurian

greywacke. On the north side of the river, Forbes and Sloat Limited crushes Mississippian basalt at a quarry at Douglas, just west of Fredericton (Figure 17).

In the Moncton area, Moncton Crushed Stone, a Division of Modern Construction Ltd., crushes granitic rocks of Precambrian age at a quarry at Stilesville, northwest of the city (Figure 17). Manufactured fine concrete aggregate is also produced by the operation, by blending crusher-produced fine aggregate with washed natural sand trucked in from the Rogersville area. H.E. Carson Limited also operates a quarry in metasedimentary rocks in the Stilesville area (Figure 17). To the east of Moncton, at Gaytons (Figure 17), Precambrian granitic rock is crushed by Acadia Crushed Stone Division of Modern Construction Ltd., and by MacDonald's Paving and Construction Limited. C.M. Stewart Company Limited operates a quarry in basaltic rock in the Dalhousie area (Figure 17).

Brookville Manufacturing Company near Saint John and Havelock Lime at Havelock (Figure 17) produce crushed dolomite and limestone, respectively, for use as aggregate, in addition to their other lime products. Elmtree Resources Ltd. of Bathurst also produces crushed limestone for use as aggregate.

A preliminary estimate of stone production for 1991 is 2 769 713 t with a value of $18 397 674 (Table 5). In comparison, 1990 production was 2 771 000 t valued at $18 098 000.

SAND AND GRAVEL

Most sand and gravel pits in New Brunswick are operated on an intermittent, on-demand basis; many of these can produce only low-specification aggregate. The few permanent operations are found where large deposits of good quality material lie within economical trucking distance of high-demand, urban areas (e.g., the Saint John area).

A preliminary estimate of sand and gravel production from Crown lands in New Brunswick during 1991 is 2 271 260 t, which provided revenue to the Province in the amount of $340 688. In addition, rentals amounted to $16 565 and fees amounted to $1400.

ENERGY RESOURCES

OIL AND NATURAL GAS

Irving Oil Limited — 21 H/15

COMPANY Irving Oil Limited, P.O. Box 1421, Saint John, New Brunswick E2L 4K1. Telephone: (506) 632-2000. The President is A.L. Irving.

RIGHTS ONG lse/on-sh 74-1 (2153.7 ha) under the Oil and Natural Gas Act, Chapter O-2.1, R.S.N.B. 1976.

LOCATION The Stoney Creek field (Lease 74-1) is located 16 km south of Moncton (Figure 17).

HISTORY Lease 74-1 is in the 8th year of a ten-year term.

PRODUCTION Oil and natural gas operators for the field are Irving Oil Limited and Moncton Utility Gas Company, respectively. Natural gas production was 6566 mcf (186 816 m^3) from January 1 to March 31, 1991, at which time production was terminated.

Year	Gas (m^3)	Oil (m^3)
1987	1 744 683	494.8
1988	1 079 540	367.1
1989	994 168	---
1990	1 064 644	---
1991	186 816	---

OUTLOOK Lease 74-1 is in good standing; its long-term status is under review.

COAL

N.B. Coal Limited 21 I/4, 21 J/1

COMPANY N.B. Coal Limited, P.O. Box 520, Minto, New Brunswick EOE 1JO. Telephone: (506) 327-3336. The President is Mr. A. Cormier. The parent company is NB Power.

RIGHTS N.B. Coal Limited holds a Coal Agreement, under the Mining Act, Chapter M-14.1, S.N.B. 1985. The Agreement includes an exploration area of 80 384.8 ha and a production area of 3061 ha in the Minto–Chipman area.

LOCATION The Minto–Chipman coalfield is approximately 60 km east-northeast of Fredericton (Figure 17).

HISTORY The first recorded coal mining in North America occurred near Grand Lake in 1639. The coal was exported to Massachusetts. Production was limited to a few thousand tonnes annually until the 1900s. Expansion of the coal mining industry was coincident with development of the railways, which not only provided transportation to markets in New Brunswick, Québec, and the State of Maine, but were also large users of coal. Construction of the Grand Lake generating station in the early 1930s provided another market for coal.

In 1942, the disposition of coal was: electric power generation, 13.5%; railways, 32%; industrial (mainly pulp and paper mills), 45%; exported to Quebed and Maine, 8%; and domestic consumption, 1.5%. Strip mining accounted for 24% of the production. Since 1971, all production has been from stripping operations.

Low oil prices in the 1960s led to the decision to form a Crown Corporation that would phase out uneconomic operations while continuing to produce enough coal for the Grand Lake generating station. The 1973 Arab oil embargo and the rapid escalation in oil prices caused a change in the attitude toward burning coal. This ultimately led to the decision by NB Power to add a 200 MW unit, which could be fuelled by oil or coal, to the Dalhousie generating station. In order to supply the necessary coal for Dalhousie, N.B. Coal Limited purchased and erected on-site a Marion 8200 dragline. This dragline, which first produced in 1979, accounts for 60% of the annual production.

Prior to 1978, mining companies did not have to be concerned about reclamation. This resulted in large areas of land that were not levelled but which did revegetate naturally. Other areas have been levelled and reforested. The present plan is to level areas and allow them to revegetate naturally. Abandoned highwalls are sloped to 45°.

In 1988, the 500 dragline was moved from the Fire Road–Bog Camp mine to the Little River mine because of the generation of low pH water at the Fire Road–Bog Camp site. Discharge waters from this site continue to be treated with lime in order to control acidity.

N.B. Coal Limited has expanded efforts to level spoil piles created since 1978. During 1990, the company had caught up with past reclamation obligations and in the future is required to reclaim only the land it mines.

RESERVES 9 600 000 t of coal, proven.

PRODUCTION 490 000 t of coal (1991); 533 500 t of coal (1990)

EMPLOYEES 1991, an average of 190 persons.

DEVELOPMENTS In 1989, N.B. Coal Limited started site preparation work in the Coal Creek area for the erection of a Bucyrus Erie 1260 dragline. The major portion of the dragline assembly was completed in 1990 and the official opening is scheduled for 1992. During the year, N.B. Coal Limited disturbed 91 ha and reclaimed 162 ha in the coalfield.

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XYZ

ABBREVIATIONS

cm - centimetre
m - metre
km - kilometre
g - gram
t - tonne
L - litre
ha - hectare
ms - milliseconds
mgal - milligal
Hz - Hertz
M - mega (prefix for 1 000 000)
t/a - tonnes per year
t/d - tonnes per day
W - watt

CONVERSIONS

Square miles (sq. mi.) x 2.589 988 = square kilometres (km^2)

Short tons x 0.907 184 = tonnes (t)

Acres (ac.) x 0.404 685 = hectares (ha)

For precious metals:
ounces per ton (oz./ton) x 34.285 71 = grams per tonne (g/t)

For oil (1 barrel = 42 U.S. gallons):
barrels x 0.158 987 3 = cubic metres (m^3)

For natural gas:
cubic feet (cu. ft.) x 0.028 316 85 = cubic metres (m^3)

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